SCIENTIFIC AMERICAN

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THE WEISS SYSTEM OF STREET CAR MOTORS.

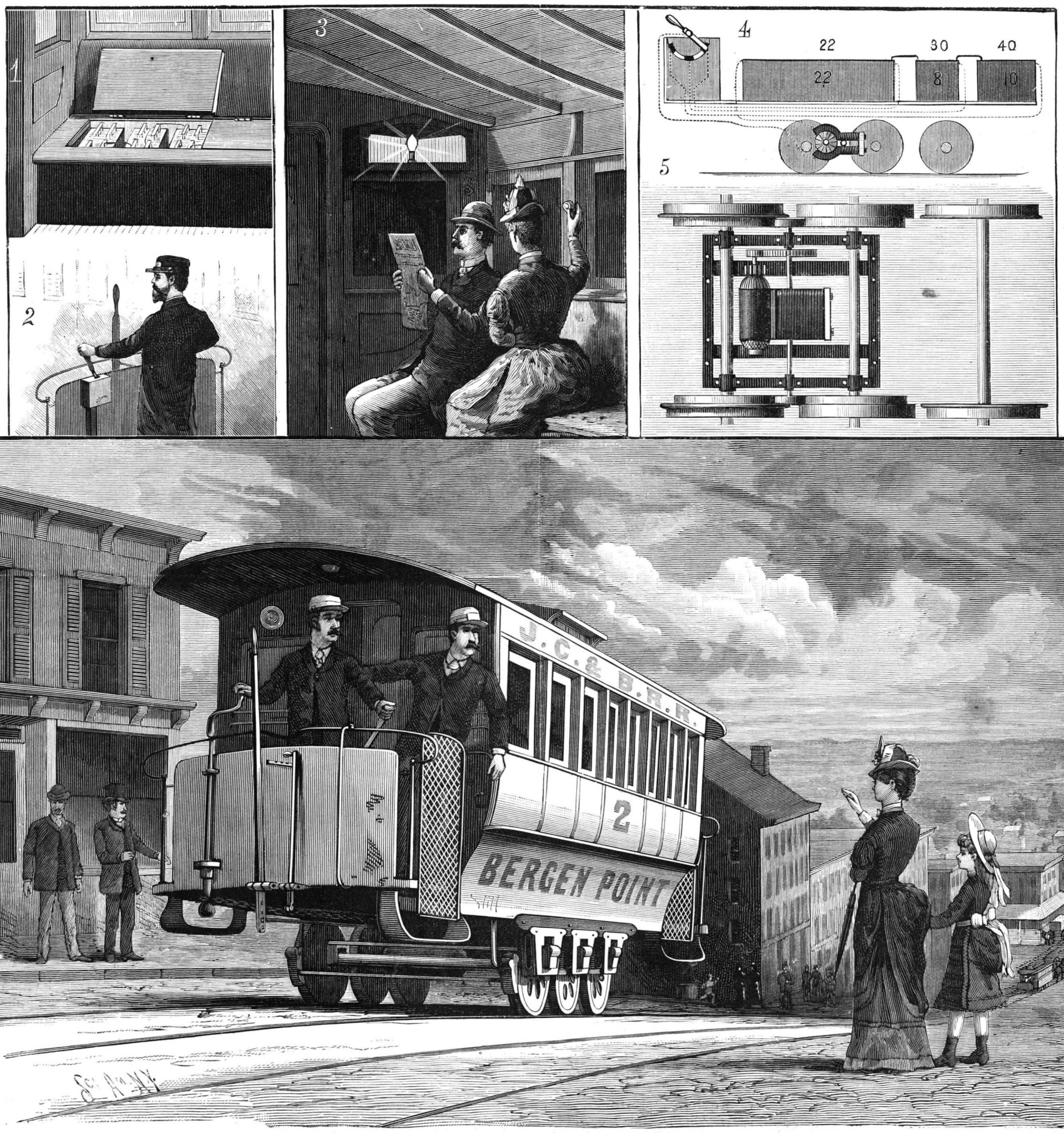
It now seems to be only a question of time as to when the use of horses for drawing street cars will be abandoned, at all events in our cities. The Third Avenue line of this city for several years past has been experimenting with cable traction, and it is just announced that it proposes adopting it for the greater part of the line. In Philadelphia, cable traction is in successful operation, and electricity is being tried. Cable traction involves the expenditure of a very large additional capital beyond what is required for rails, cars, and ordinary equipment.

For this and other reasons, the processes that, on general principles, should be considered the most advanced are those dependent on electricity as the motive power. It is satisfactory to note that they are gradually obtaining a foothold. They may be divided into three types. In one, an overhead wire is needed; in another, an underground wire or third rail is used to carry the current; in the third system, storage batteries are employed. Each system has its good and bad points, to which only brief reference need be made here. Occupants of streets through which the cars pass object very strongly to the appearance of the line of poles. This point was so strongly urged in one recent instance as to cause the abandonment of electricity by a car company in a city near New York. In favor of the storage battery system, as opposed to both of the other ones, is to be cited the feature that each car carries its own power. In case of an accumulation of cars upon a heavy grade, this might be of importance. It is quite conceivable that by this occurrence so great a demand for power might be made upon the station, where electricity was supplied by a transit wire or rail, that all the cars could not ascend the grade together. Against storage battery systems the objection is made that the very heavy batteries have to be carried with the cars, and so increase the dead weight.

The system we illustrate in this issue is one whose distinguishing peculiarity is adapted to any of the three typical methods of supplying electricity. It is here shown as applied to a car of the Jersey City and Bergen line, which is driven by accumulators. In applying it a special study has naturally been made of the battery system, and in all its features the car represents the results of much thought, which results are to be still the subjects of modification, if on trial any change seems desirable.

Under the seats on the sides of the car the battery is kept. It consists of sixty cells of the Julien battery,

(*Continued on p.* 308.)



1. The Battery. 2. The Driver. 3. Interior of the Car. 4. Dynamo and Battery Connection. 5. Frictional Driving Gear.

THE WEISS ELECTRIC STREET CAR AND THE WEISS SYSTEM AS APPLIED IN JERSEY CITY, N. J.

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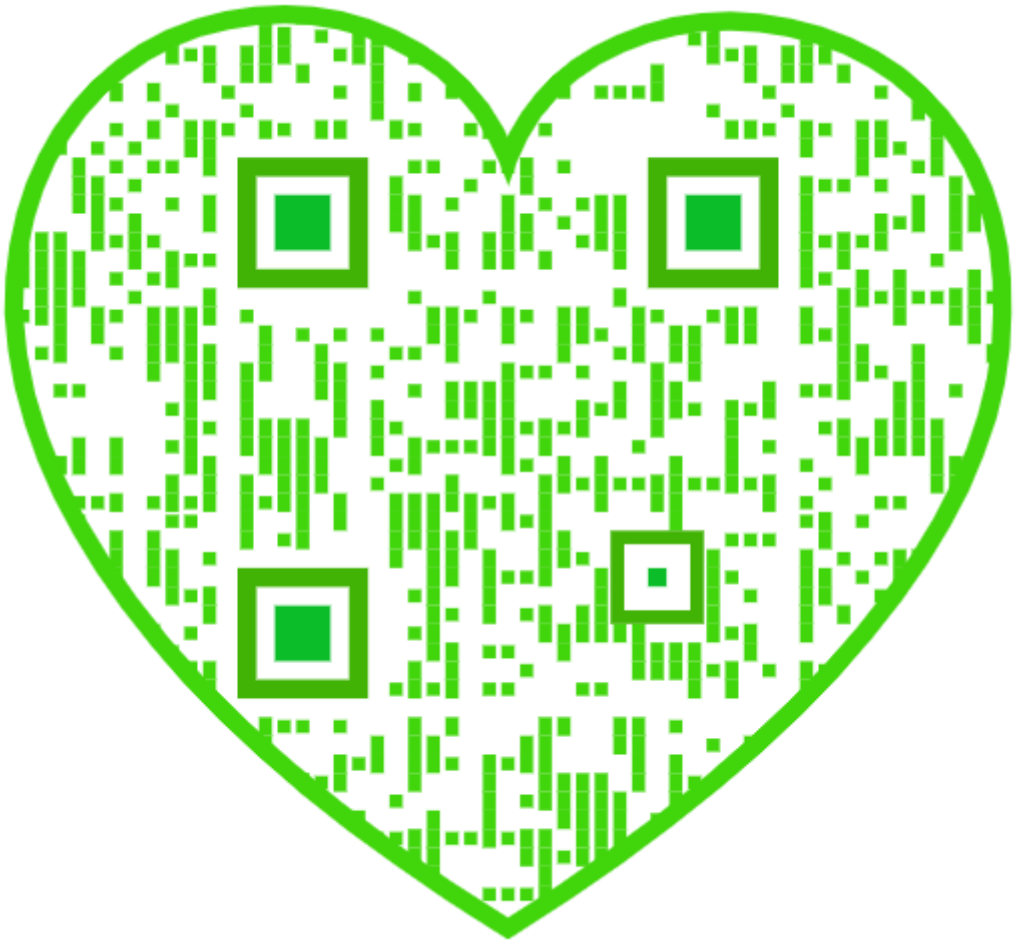

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NEW YORK, SATURDAY, NOVEMBER 12, 1887.

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THE RICH COAL FIELDS OF COLORADO.

Prof. Newberry, of Columbia College, at a meeting of the New York Academy of Sciences, October 31, gave an enthusiastic description of some exceedingly rich coal fields in western Colorado. He exhibited specimens of coal that he had taken from various veins there but a few weeks ago, equal to any mined anywhere in the world, some of it showing only three per cent of ash and one-half of one per cent of sulphur. Some of the coals were anthracite and others bituminous, with an abundance of excellent coking coals, portions of some veins just as found comparing favorably with the best Connellsville coke.

One of the veins he described as 18 feet thick of solid coal, with numerous other veins of 14, 10, 8, and 6 feet thickness. Three railways are now approaching this wonderfully rich coal field, and, notwithstanding the great difficulties attending freight transportation in so mountainous a region, its almost exhaustless stores of the best of fuel will soon be furnished in abundance for that large section of almost treeless country just east of the foothills of the Rocky Mountains, from Dakota to Texas.

BOOKS FOR THE INSANE IN ASYLUMS.

From Georgia a very touching appeal has reached us. The State Lunatic Asylum at Milledgeville has within its walls between twelve and fifteen hundred patients. Many of them are not only well able to read in spite of their mental infirmity, but really need and crave some such literary exercise. A hall within the institution is fitted up for a library, but there are no books. To supply this pressing need, contributions of any kind, old books, magazines, periodicals, and the like, are solicited. We trust that many will respond to the demand, directing their contributions to the superintendent, Dr. T. O. Powell.

We notice the above mentioned appeal not only for its own sake, but because it seems to us the index of what is probably one of the great needs of our country. All through it are large insane asylums, but in how many of them is there any certainty that a sufficient library is provided for the inmates? No class would seem so open to benefit from literature as the insane. The majority are monomaniacs, or at least possess a part of their understanding. They emphatically require to be taken out of themselves. The error many sane people make is to depend too much on reading and too little on thought. The reverse may be made an aphorism for the insane, as they certainly brood or think too much.

It would appear that an opening for a most beneficent charity might be found in this direction. The asylums of the country should be investigated, and the extent of their libraries determined, and efforts made to supply their deficiencies. Every house has in it some unused books that idly fill the shelves, and which having been read once are never again opened. These could find no more useful destination than the one suggested. Many periodicals accumulate, to be ultimately destroyed. All such we are sure would be gladly received by the superintendents of the insane asylums.

So much is now done by organized charity that the suggestion of a new field for work will undoubtedly find many willing to assist in it. The question of the character of the books might safely be left to those in charge of each asylum. Even if the indiscriminate use of books were permitted, then for one patient who would be excited or injured by some work fostering or increasing his delusion, probably hundreds would be benefited. If ill effects were feared, the books could be examined and weeded out before being sent.

It is clear that a need exists, and that it is one which can be easily supplied. We hope soon to receive evidence that work is doing in this field.

THE AMERICAN INSTITUTE EXHIBITION.

The American Institute exhibition in this city is now at its best. In general it is fully up to the standard of former years, and in some respects it is far in advance. The electrical display is especially noteworthy. A large number of dynamos and electric motors are shown in operation. The halls are illuminated by electric light exclusively. The arc lights, 100 in number, within and without the building, are operated by four Ball unipolar dynamos, driven by a smooth running high speed engine made by the Ball Engine Co., of Erie, Pa.

Two No. 16 400 ampere Edison dynamos are exhibited, one being used for incandescent lights, and the other for supplying current to motors. One of the Edison machines is driven by the well known Armington & Sims high speed engine, the power being communicated from the engine to the dynamo by a leather link belt. This belt hugs the pulleys closely, and envelops much more of their peripheries than does the ordinary belt. The other Edison dynamo is driven by a Straight Line engine, which seems to do its work quietly and with great ease.

The Mather Electric Co., of Hartford, Conn., exhibit a 500 light dynamo, driven by a Trenton high speed engine, made by the Phœnix Iron Co., of Trenton, N. J. This dynamo supplies a current to 500 incandescent lamps. Another 250 light machine of the same make takes its power from the line shaft of the exhibition building, and supplies a current for running various electric motors. A 50 light dynamo of the same make furnishes a current for the "C. & C." motors.

The Oerlikon Machine Works, of Switzerland, exhibit a compact, efficient dynamo, running incandescent and arc lamps in the same circuit. It has a capacity of 120 incandescent lamps and 12 arc lamps.

The Mutual Electric Manufacturing Co., of Brooklyn, exhibit the Knowles system of electric lighting, in which the dynamo supplies a current to arc and incandescent lamps, and also to motors upon the same circuit. The feature of the dynamo which renders this possible consists of a very sensitive regulator, which is capable of quickly shifting the current according to the electric load. This dynamo is driven by a Hill clutch and pulley on a line shaft.

A feature of electric lighting which has often been discussed, but never practically realized until now, is that of economically producing steady incandescent electric lights through the agency of the dynamo by power derived from a gas engine. Otis Brothers & Co., of New York, exhibit a 4 h. p. Baldwin gas engine, which drives a United States dynamo, and furnishes a current to thirty-two 16 candle power incandescent lamps. The engine, consuming 30 ft. of gas per h. p. per hour, makes the expenditure of gas for the production of 16 candle power 3¾ ft., whereas a 15 candle gas light requires 5 ft. of gas per hour. The lights are readily maintained at a high incandescence, and are absolutely steady. To show the possibilities of electric illumination by means of a gas engine, the dynamo driven by the Baldwin engine is connected with a Julien storage battery when not furnishing a current directly to the lamps. The storage battery requires about five hours for charging, and will maintain 52 lamps for about three hours, thus making it possible to furnish 84 lights with a single 4 h. p. engine.

The gas engine exhibit of the present year excels that of any previous year, both as regards the number shown and the variety and quality of the engines. Messrs. A. C. Manning & Co., agents for the Otto engine in this city, exhibit a 10 h. p. engine running idle, a 7 h. p. engine running arc lights, two 4 h. p., one 2 h. p., and one 1 h. p. engine. The 7 h. p. engine drives a Waterhouse dynamo, which supplies a current to 8 arc lamps. The Clerk gas engine is in place, but not in operation. The Charter gas engine is also in place, and is occasionally in operation.

The Economic Gas Engine Company have an exhibit of six small engines, ranging between 1 man power and 1 h. p. These little engines are extensively used in and about New York for pumping water for household purposes and for running light machinery. They are exceedingly simple and well adapted for any use requiring not more than 1 h. p.

Undoubtedly the greatest novelty exhibited this year is that of the electric welding of metals. This new art of electric welding is one discovered by Prof. Elihu Thomson, of Lynn, Mass. The invention is under the control of the Thomson Electric Welding Company, of Lynn, Mass. The welding is accomplished by sending a very heavy current of electricity through the bars of metal to be joined by welding, the resistance offered by the comparatively imperfect contact between the abutting surfaces serving to create a temperature sufficiently high for the purpose. As the contact surfaces soften under the great heat, they are forced together, and the heat extends to the contiguous surfaces until the adjoining ends are in perfect contact and the union of the metal is complete.

In the exhibit the current is furnished by a Thomson-Houston alternating current dynamo of high voltage, and this current is reduced to low voltage and large quantity by a transformer consisting of a primary and secondary coil and a magnetic core. The primary wire in this case, unlike an ordinary induction coil, is small and long, while the secondary conductor is very large and short. The terminals of the secondary conductor are connected with the clamp by which the material to be operated upon is held in position for welding. There seems to be no limit to the possibilities of this process. All of the metals, so far as known, may be successfully welded by the electric current. No exception is made of aluminum or cast iron. Wrought iron, steel, brass, and copper are readily united, the joint being generally stronger than the other portions of the metal. Unlike metals are also successfully welded—iron and steel, brass and iron, and brass and German silver are examples.

Among electric motors in operation will be found the Daft motor, driving a street car, another applied directly to a Sturtevant blower, another operating an elevator. The Sprague Electric Company show a motor running a band saw, another running a printing press, another driving a large blower. This company also exhibit a railroad car having the electric motor attached. The "C. & C." Electric Motor Co. exhibit a large number of their motors of different sizes, doing various kinds of work—running sewing machines, blowing organs, operating ventilating and cooling fans, etc.

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The historical exhibit of the New York Electrical Society includes Franklin's original frictional electric machine, one of Morse's early telegraph instruments, Moses G. Farmer's original self-exciting dynamo, first exhibited by the inventor in 1872, a Saxton's magneto-electric machine, which was exhibited at the British Association in 1833, and a great variety of telephones and other electrical devices too numerous to mention.

James W. Queen & Co., of Philadelphia, have a very creditable exhibit of fine electrical instruments, many of them of quite recent invention. Among them we find Hartmann & Braun's Siemens' universal galvanometer, Weideman's reflecting galvanometer having a Siemens bell magnet, Kohlrausch's Wheatstone bridge made by Hartmann & Braun, also a rheostat graduated to the new ohm, a variety of Deprez-Carpentier's ammeters and voltmeters, a Sir William Thomson's reflecting galvanometer made by Elliott Brothers, London, a variety of Ayrton & Perry's measuring instruments, a Charles Siemens' half meter bridge, and many other modern electrical instruments.

The Writing Telegraph Co. exhibit one of their instruments, which attracts a great deal of attention, the pen of the receiving machine which writes without any apparent controlling power being the center of attraction.

In no branch of the electrical department is the progress of electrical science better shown than in the various exhibits of electrical conductors. Among these we mention the exhibits of the Scoville Manufacturing Co., the Washburn & Moen Manufacturing Co., and Holmes, Booth & Hayden Co., which include every variety of plain and insulated wires. Also the exhibits of the Okonite Co., the Bishop Gutta Percha Co., and Day, comprising cables for aerial, marine, underground, telephone, telegraph, and electric light lines.

Luminous Organs of an Insect.

Dr. Dubois has investigated the light-emitting organs of the *cucuyo*, or *Pyrophorus noctilucus*. They are three in number—two prothoracic and one ventral. The prothoracic plates give a good illumination in front, laterally, and above, and serve when the insect walks in the dark; when it flies or swims, its fine abdominal lantern is unmasked, throwing downward an intense light with much greater range. The insect seems to be guided by its own light. If the prothoracic apparatus is quenched on one side with a little black wax, the cucuyo walks in a curve, turning toward the side of the light. If both sides are quenched, it walks hesitatingly and irregularly, feeling the ground with its antennæ, and soon stops. The light gives a pretty long spectrum, from the red to the first blue rays, is more green than the light of *Lampyris noctiluca*, and is capable of photography, but does not develop chlorophyl. No distinct electric action could be traced to the organs. The luminosity does not depend upon oxygen, for it is the same in pure oxygen, in air, in pressures under one atmosphere, and in compound oxygen. The organs are still brilliant when separated from the body, but the power of emission appears to depend upon a supply of water, and it is recoverable, after thorough drying, upon putting the organs again in water. Dr. Dubois found that the photogenic substance is an albuminoid, soluble in water and coagulable with heat, it entering into contact with another substance of the diastase group. Part of the energy liberated appears as light.

Atmospheric Electricity.

Prof. L. Weber, of Breslau, read a paper before the British Association, on "Observations of Atmospheric Electricity." Prof. Weber said that the increase of potential seemed to be a linear function of the height; but the presence of dust in the air disturbed this relation. The earth represents a surface of equipotential, and the other surfaces of equipotential are parallel, but come closer together above the mountain tops.

Prof. Schuster said that, granting that the earth has a given potential at any moment, the convection currents in the air would tend to reduce this, or to equalize the potential within the earth itself.

Prof. Everett remarked that wherever electricity is carried down by raindrops, an inequality of potential will be caused; and evaporation would also cause inequalities.

Prof. Rowland said that observations had been made during the last four years at his laboratory by the U. S. signal service. He did not see how the raindrops could disturb the distribution of potential much. If the earth is electrified, most of the electricity would be on the outside of the atmosphere. He therefore looks for some other theory, and has given one in the *Phil. Mag.*, viz., that the earth would naturally be uniformly electrified if it were not for currents of air in the upper atmosphere, which will carry the electricity of the atmosphere toward the poles, making auroras there. At the equator, therefore, a space must be left which has to be filled up with electricity, and this takes place by thunder storms. Accordingly, there is a circulation of electricity. In this connection it is to be remembered that thunder storms are most common about the equator.

Writing and Drawing on Glass.

Fine ground glass is nearly as easy to work upon with pen and pencil as note paper. Such glass as is used for the focusing screens of cameras is suitable for this purpose. The roughness of the surface prevents to some extent the spreading of the ink, and by the latter being absorbed, as it were, into the minute depressions, we obtain blacker lines than we should get on smooth glass. Water colors can be easily applied with a brush. It is best to mix them with a weak solution of sugar or gum, and to prepare the glass for the colors by a preliminary rub with a cloth made damp with the same fluid. After the writing is completed, the appearance of plain, unground glass may be produced by varnishing it. Negative varnish, containing shellac, will do very well, or Canada balsam, thinned with benzole, may be used. The latter will take some hours to dry, during which it should be carefully protected from dust.

Matt varnish may be used to impart an artificial grained surface to smooth glass. It is easily made by dissolving ninety grains of gum sandarac and twenty grains of gum mastic in two ounces of ether, to which is added benzole, the amount of which may vary from half an ounce to one and a half ounces, according to the fineness of the matt required. This fluid is applied by pouring it on the cold plate. As soon as the varnish has set, the glass may be heated to insure a firm and even grain. Upon this surface, writing with a pen or pencil can be easily executed when dry. A sirup or gum arabic solution may be applied with a brush to restore the appearance of unground glass. As sandarac, the chief constituent of matt varnish, is soluble in methylated spirits, we cannot use collodion or shellac varnish to impart transparency. So we are obliged to adopt a water solution, such as sirup, as a protection for lead pencil work, while in the case of ink Canada balsam may be used.

Resin is one of the substances that enable us to work with a plumbago point upon a smooth surface. A thin film of the gum is easily produced from a solution of it in turpentine or benzole, in the same way as gum dammar is used, and resin being of a brittle nature, a little caoutchouc added to this solution will be an improvement. Resin is remarkable in its way, for it dissolves in methylated spirits as well as in turpentine. The former solvent (or spirits of wine) is the best for our purpose, as it contains no grease; and as Canada balsam, thinned with benzole, is also mixable with spirits of wine, a very small quantity of it may be added to the resin solution, to impart the requisite toughness and adhering power. A plain glass coated with this medium can be worked upon with pen and pencil, but it is not equal to gum dammar as a help to retouching, as the resin, though it is brittle when cold, is apt to become tacky when heated, which might occur in printing off a negative in the sun. Another fault is that the resin film dissolves when the negative varnish is applied, so that work done by the lead pencil is exceedingly apt to become displaced. The only chance of a disturbance not taking place is when the resin film is very thin, and the pencil point is hard and sharp, so that the impression is driven into the gelatine basis.

Sugar, although not generally known as a medium for writing on glass, is perhaps the very best. I have used it for some months, and prefer it to any other substance, gum dammar included. It is suitable both for the lead pencil and for the pen. If a sketch in lead pencil upon clear glass is wanted as a lantern slide, I would use a film of sugar, as I could produce thereon lines almost opaque in their blackness, and shading of any depth, combined with a singular freedom from grit. With a gum dammar film the lead is apt to break off in tiny pieces, and a shade, or half tone, cannot be easily produced free from black specks. If an ink sketch or writing is required, with lines clear and distinct, then I would again use a sugar film, as I could produce thereon with ease the finest lines that a pen could trace. The ink, prepared itself with sugar, takes perfectly to the sugar surface, and shows no tendency to spread over the glass. There is no trouble in getting the ink to flow from the pen. Sugar in solution is very tenacious of its continuity, and does not easily divide into drops, which cause blots in writing. Sirup has the same characteristics as thin treacle—we cannot divide treacle into small drops. If we pour it slowly from a bottle we obtain an attenuated thread of the substance. So sirup in a pen forms a narrow thread at the nib point, and being previously darkened with lampblack or other pigment, enables the finest black lines to be produced if required.

Saccharine matter exists in various well-known forms—there are white, brown, lump, crystallized, and moist sugars, and there is treacle. Treacle is a very good thing no doubt, but it is useless for our purpose, as it resembles calcium chloride in its power of absorbing moisture. It can be hardened by heat, but if exposed to the atmosphere it soon regains its pristine softness. Brown or moist sugar partakes of the nature of treacle to some extent. It can be dried by heat, but it absorbs a little moisture afterward. White sugar, on the contrary, has little tendency to become softened by damp, and for an ink sketch on glass, a sirup made by dissolving white sugar in cold water is the best medium. Such a film, when perfectly dry, presents too hard and polished a surface for the lead pencil. By breathing on it the sugar becomes softer, and it then takes the lead perfectly. There is, however, some danger of overdoing the softening process, the result of which is that the lead point sinks into the film and causes a furrow instead of a clear line on the surface. So for the lead pencil I prefer to use white and brown sugar in equal parts, dissolved in cold water. This sirup may be spread on the glass either by pouring or with a brush, and the film may be quickly dried by heating the glass plate. But there is a better way of applying an even film of sugar to glass. Thin sirup has the curious property of being mixable with methylated spirits without causing the precipitation that occurs when gelatine or gum arabic is so treated. Thus we can add sirup to alcohol and coat a hot glass plate exactly as if we were using negative varnish. The film will be dry in a minute or so, and if the glass is perfectly clean the sugar will be equal in thickness throughout. It is best to mix the thin sirup with alcohol in equal proportions and to use it at once. If left at rest for some days a portion of the sugar is deposited in crystals on the sides of the containing bottle, and the mixture does not then produce so even a film as at first. The glass should be made quite hot before pouring on the fluid, to secure the best result.

Sugar dissolved in water does not act exactly as a salt would do. The latter usually dissolves to a certain extent in cold water, and to a greater extent in boiling water. When the water cools, a portion of the salt is precipitated. White sugar, so far, does the same. If a solution of salt in cold water is allowed to evaporate slowly, the salt is gradually thrown down in crystals, but sugar so treated does not crystallize. It becomes of a thick, pasty consistence and dries eventually as transparent as glass and with the same polished surface. So we can use sirup as a varnish, but salt we cannot.

A great advantage of the sirup foundation in writing on glass is that a shellac or mastic varnish can be applied as a protection against damp without the slightest fear of disturbing the design. We have seen that a resin film dissolves if varnished. A gum dammar film resists a spirit varnish better, but a pen and ink sketch thereon becomes wofully faint and attenuated. I presume that the sugary ink becomes softened under the hot varnish and shrinks up, so that the lines become finer. A similar sketch on a sugar basis is unaffected during the varnishing process.—*Albert Wm. Scott, in The British Journal of Photography.*

Ring Spinning.

Predictions made by one of our contributors many years ago, that the ring frame would eventually supersede the mule for spinning cotton yarns, were received by manufacturers as well as by the operators of mules with an incredulous smile. But the revolution in spinning has outrun the sanguine anticipations of the writer to whom we allude, and within the last ten years the introduction of ring frames has gone on with remarkable rapidity. Most of the new mills that have been built within that time have adopted the ring frame for the spinning of warp yarns, and a number of the older mills have thrown out their warp mules and largely increased their spinning capacity by the substitution of the more modern machine. More recently the mule has been completely abandoned in the spinning department of latest constructed mills, in which both warp and weft yarns are successfully spun on ring frames. The new Flint mill led off in this city in the adoption of this system, but not before its practical utility had been demonstrated at Newburyport, Amesbury, and Lowell. The Seaconnet and Osborn No. 2 have followed suit, and the projected new Sagamore, if built, will spin frame yarns only. The ring frame has been much improved in recent years, and its general introduction has resulted from the invention of ingenious devices by several skillful mechanics, that permitted of the adoption of a light running spindle at a high rate of rotation, and to the persistent and enthusiastic efforts of Mr. George Draper, whose personal interest as well as his clear conception of the superiority of the ring frame led him to urge its adoption by cotton manufacturers. The practical advantages of the ring frame have fully met the expectations of those who have adopted it. Double the number of mule spindles can be operated on the same floor space by the use of frames. The yarn can be spun at less cost, is stronger and more even, and consequently makes a better quality of cloth. These advantages are sufficient to insure the final substitution of ring frames for mules.—*Fall River Daily News.*

Intrinsic Light.

M. D. Monnier defines the intrinsic light of a lamp as the ratio of the photometric power to the illuminating surface. The following figures are given as the intrinsic light of certain lamps:

Argand burner	0·3 candle per sq. cm.
Siemens regenerative burners	0·6 " " " "
Incandescent lamp	30·0 " " " "
Arc lamp	480·0 " " " "

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INTERESTING EXPERIMENTS WITH SIMPLE APPARATUS.

H. J. HOLDEN.

Several very interesting philosophical experiments, which are seldom attempted by those who are not supplied with costly apparatus, may be performed in a satisfactory manner by the use of a pair of Argand lamp chimneys and a supply of rubber and glass tubing (nursing tube). These can be obtained at any drug store, and the cost need not exceed fifty cents, except in experiment Fig. 14, shown in engraving.

The rubber tubing can be conveniently coupled to any desired length by using pieces of the glass pipe.

The stand, a section of which is shown in Fig. 3, although not absolutely necessary, is very convenient, and should be made of some heavy material.

The necessary corks should be of good quality. Rubber corks, if they are obtainable, serve the purpose in a most satisfactory manner.

By referring to the illustration, Fig. 1 will be seen to represent a level with its air bubble in proper position. To prove its accuracy, reverse the glass on a surface to which the level has been applied. Fig. 2 represents a siphon arranged to show that water seeks its level.

Tantalus' cup is shown in Fig. 3. A piece of glass pipe through the cork, at the lower end of the chimney, couples the curved pipe above to the discharge pipe below.

The arrangement of apparatus in Fig. 4 will also show that water seeks its level.

In the fountain the end of the glass tube should be drawn out to small size by heating in the flame of a spirit lamp. If the jet is perpendicular, it may be made to support a pith ball. If it is discharged at an angle, the parabolic course of a jet of water may be traced.

With the same arrangement the equilibrium tubes may be produced. See Fig. 5. If the water rises somewhat higher in the glass tube than in the chimney, it is due to capillary attraction.

The experiment with the fountain may be varied by removing the rubber tube, pushing the fountain nozzle through the cork into the chimney, and immersing the apparatus in water, as shown in Fig. 6. There will be a jet in the chimney, which will also illustrate the theory for the action of artesian wells.

Torricelli's principle is shown in Fig. 7. Choose a chimney with a level edge, invert it, and connect the rubber tube with the small end of the chimney by means of a piece of glass tube put through a cork. Wet a piece of blotting paper and use it in making an air-tight joint between the upper edge of the chimney and any plane surface, as a pane of glass or a tea plate. Fill the chimney with water, press it against the plane surface, and it will adhere with more than sufficient force to support itself.

A similar but less striking experiment, shown in Fig. 8, is performed by filling the chimney with water, leaving the large end open. Dampen a piece of paper, press it against the edge of the chimney, and invert it. The water will not escape, and the paper will retain its position.

Fig. 9 represents Mariotte's vase. The chimney is closed, above and below, with corks, each of which is pierced by a glass tube. When the chimney is filled with water, none will escape below until air descends in the tube and rises in the chimney.

In Barker's mill, Fig. 10, the chimney is inverted and suspended by means of a strong thread. A large cork, in the lower end, serves to hold the bent tubes in position. These tubes should be made of glass, but a piece of the rubber tube will serve the purpose, if curved and held in place by means of a stiff wire. The arms may be reversed and cause the mill to rotate in an opposite direction, or with the arms operating in the same direction there will be no revolution. In Fig. 11 the Cartesian diver is represented by a small vial, which is inverted in the water with sufficient wire wound about its neck to nearly overcome its buoyancy. The chimney is filled with water and the upper cork is pierced by a glass pipe, to which is coupled a length of the rubber tube. A quick expulsion of breath is sufficient to send the vial to the bottom, and when the pressure is removed it will rise again. It will increase the interest of the experiment to have another vial with more ballast, which will not rise until suction is applied. In place of the usual imp attach a small china doll to the vial. It will serve as ballast.

If a piece of tin, cut in the shape of two blades for a screw propeller, be fastened to the vial at the neck and properly bent, it will rotate as it ascends and descends.

Fig. 12 represents a diving bell working on the same principle as the previous experiment. It also illustrates one method adopted to raise sunken ships. See SCIENTIFIC AMERICAN, July 9, 1887, page 23.

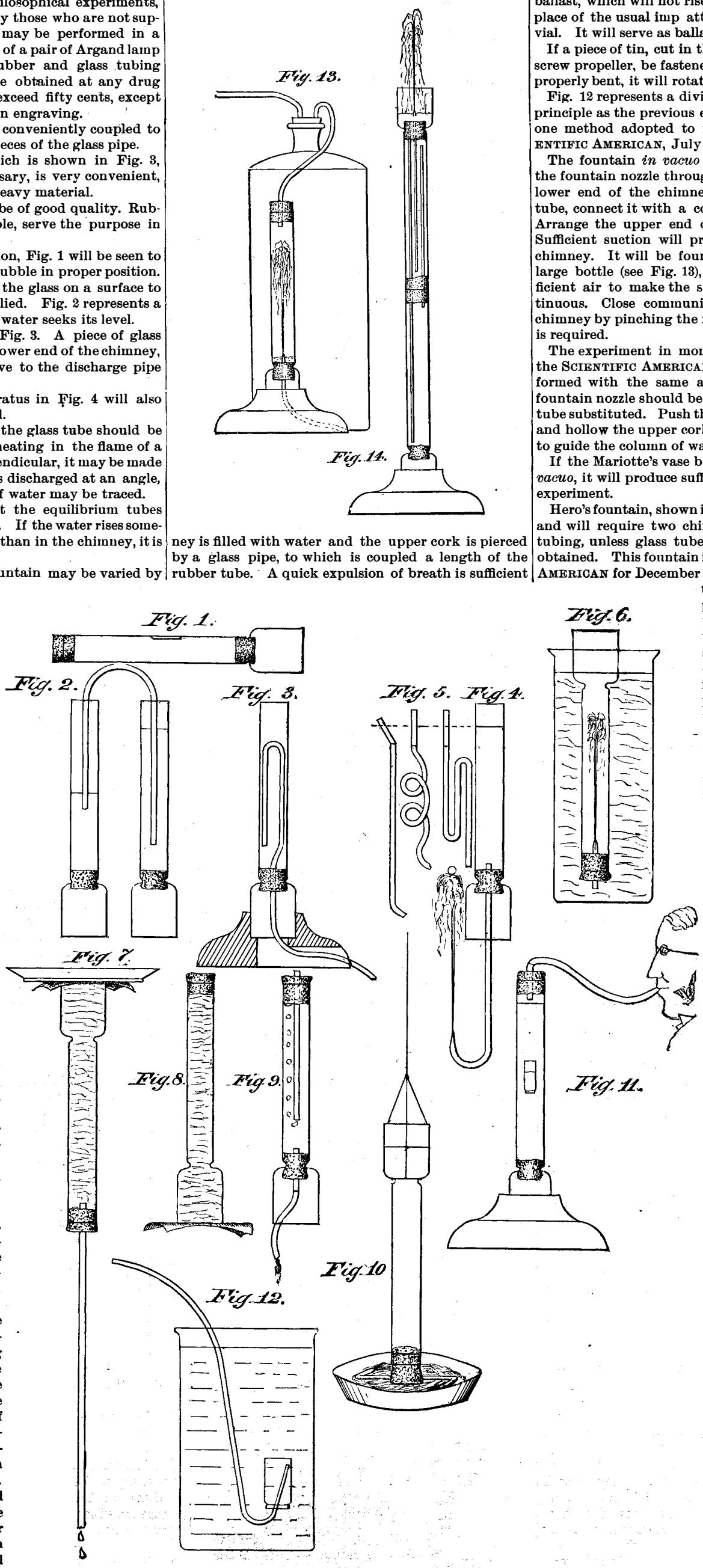
The fountain *in vacuo* is shown in Fig. 13. Push the fountain nozzle through the cork, which closes the lower end of the chimney, and, by means of rubber tube, connect it with a convenient reservoir of water. Arrange the upper end of the chimney as in Fig. 11. Sufficient suction will produce a fountain within the chimney. It will be found more convenient to use a large bottle (see Fig. 13), from which to exhaust sufficient air to make the suction more regular and continuous. Close communication between bottle and chimney by pinching the rubber tube until the action is required.

The experiment in momentum of liquids, shown in the SCIENTIFIC AMERICAN for May 28, 1887, can be performed with the same arrangement, except that the fountain nozzle should be removed and a straight glass tube substituted. Push this tube well into the chimney and hollow the upper cork to a funnel shape, in order to guide the column of water.

If the Mariotte's vase be attached to the fountain *in vacuo*, it will produce sufficient vacuum to perform the experiment.

Hero's fountain, shown in Fig. 14, is more complicated, and will require two chimneys, also some brass or tin tubing, unless glass tube of sufficient length can be obtained. This fountain is described in the SCIENTIFIC AMERICAN for December 4, 1886, but the glass apparatus there shown is not easily procured. The chimneys and tubes answer the purpose very well indeed. The construction will be readily understood by referring to the illustration or to any natural philosophy. Noticethat when the water in the upper chamber sinks below the jet tube, the air will force the last few drops in the tube to a surprising height. The fountain may be made similar to the glass apparatus, if enough rubber tube be used, with three chimneys for reservoirs.

These and other experiments which may be performed with this simple apparatus will furnish much valuable information if, during their performance, there is study into the cause of the phenomena and reference, when necessary, to the philosophy.



INTERESTING EXPERIMENTS WITH SIMPLE APPARATUS.

An Artesian Well at Frankfort, Dakota.

A correspondent writes: "I recently passed through the town of Frankfort, Moody Co., Dakota, where they have just completed for the town an artesian spouting well of soft water. It discharges a large volume out of an 8 inch iron pipe at a point about 30 feet above ground. They told me the contractor bored 900 feet, and left the pipe about level with the ground. Next morning it had disappeared, and it was found to have sunk 100 feet, and water was pouring out of the hole in large volumes. They had difficulty in getting it under control. The contractor thought it had sunk into a sort of lake or chamber at the bottom. The water is soft and palatable. It is proposed to use the surplus for running their new elevator instead of steam. If such wells can be struck at 1,000 feet at a cost of $3,600, same as this cost, there should not be much trouble in obtaining cheap power on the Dakota prairies."

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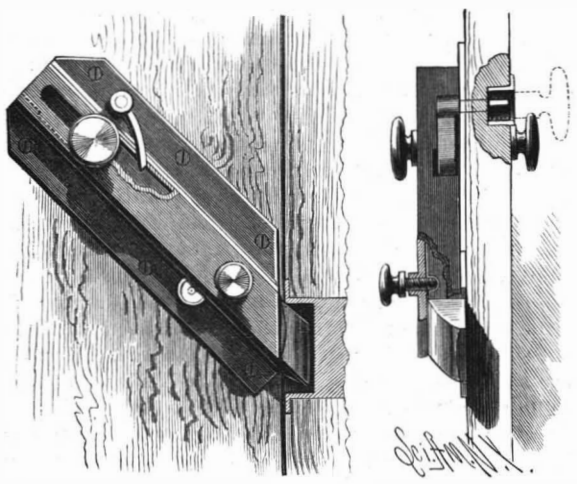
AN IMPROVED DOOR LATCH AND LOCK.

A door latch and lock constructed to operate entirely without the use of springs has been patented by Mr. Benjamin F. Pierce, of Chesterfield, N. H., and is shown herewith, one figure representing a broken front elevation of the lock applied to a door and frame, and the other showing a sectional edge view. The casing is formed with a central channel and side flanges, and secured in an inclined position on the door, and in the channel is held a bolt having its lower end obliquely beveled, so that when the door is closed it will ride smoothly and squarely upon a beveled striking plate attached to the door frame. The bolt is automatically locked in its lowest position by a shoulder near its

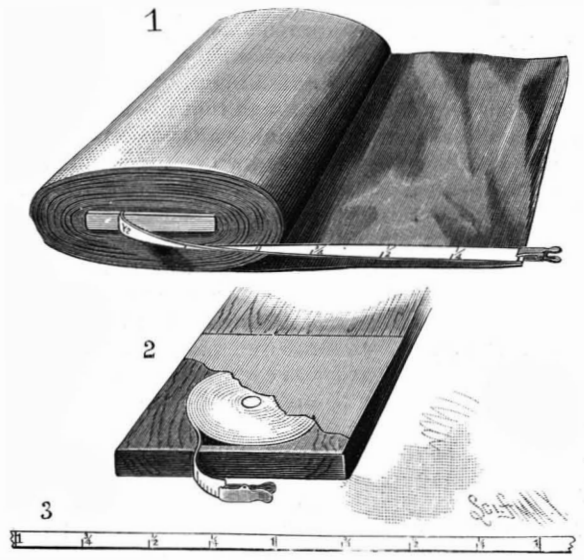


PIERCE'S GRAVITY DOOR LATCH AND LOCK.

upper end dropping into engagement with a shoulder in the channel, but the bolt may be slid upward to open the door by a spindle with a knob near the upper end of the channel. To facilitate the movement of the bolt, an anti-friction wheel, upon which the bolt rests, is fitted in the lower wall of the channel, and there is an adjacent set screw which may be turned down to prevent the bolt from being moved upward. As an additional lock for the bolt, a pawl is adapted to fall through a slot in the upper wall of the channel and engage with a notch in the bolt, the pawl being secured to a spindle of polygonal form at its outer end, which reaches into a socket in the door to receive the key, shown in dotted lines. When the bolt is not locked by the set screw or the pawl, it may be operated by a knob to open the door from the outside.

AN IMPROVED CLOTH MEASURING DEVICE.

A device which enables the retailer to readily measure off goods when selling them, and see at a glance the



BROWN'S CLOTH MEASURER.

length of remnants, in order to guard against cutting into full patterns, is represented herewith, and has been patented by Mr. J. Q. Brown, of Eagleville, Mo. A measuring tape is attached to the board or core on which the cloth is wound, in the manner indicated in Fig. 2, its outer end detachably connected to the outer end of the cloth by a spring clamp, and the tape is graduated on both faces into yards and parts of yards, the measures on one face, however, indicating only single yards and parts thereof, as shown in Fig. 3, while on the other face are given successive numerals to show the entire number of yards. As the cloth is reeled off or unwound, the tape is drawn out and laid along its edge, and the cloth and tape are cut together, the tape always showing on one side the precise length of the goods remaining on the bolt, while the unnumbered side of the tape facilitates the measuring off of the cloth as required. After the piece wanted is cut from the bolt, the tape is clamped at the end of the goods, with its numbered side or face out, in such way as to indicate the quantity in the roll without necessitating the removal of the goods from the shelves.

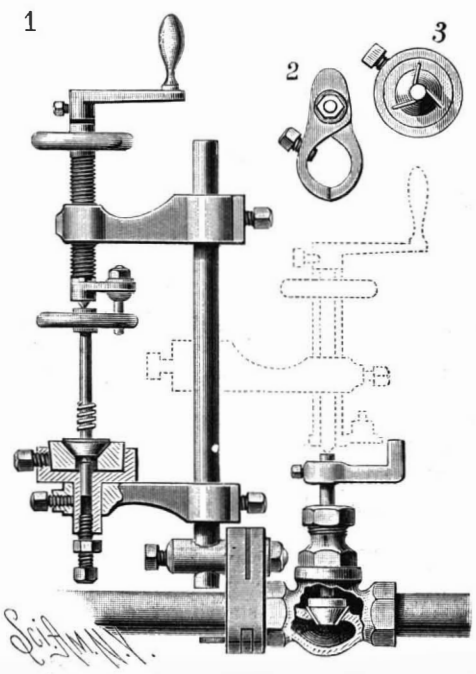
Motion of Waterspouts.

On the recent waterspout in Lake Geneva, M. H. Faye, in reply to M. Ch. Dufour's letter to the Academy of Sciences, Paris, stating that several persons had noticed an *ascending* gyratory movement in the waterspout that swept over Lake Geneva on August 19, points out that, although the movement is really descending, as he holds against most meteorologists, there is nothing remarkable in this apparent contradiction, which is due to a purely optical illusion on the part of the observers. In the same way the spirals of a vise or screw, placed vertically to a horizontal base, when turned in the reverse direction, seem to the spectator to ascend along the line of the main axis, presenting the appearance of continually retiring from the base upward, and burying themselves in the handle or top cross piece. The cause of the illusion is simple enough. Each anterior semi-spiral is successively replaced, as the screw revolves, by the posterior half, which, being at a higher level, the visible half spirals, taken separately and together, seem to ascend. So with waterspouts, which, as already repeatedly explained, never ascend, but always descend, being the result of forces having their existence in the upper atmospheric regions.

AN IMPROVED DRILL FOR RENEWING WORN OUT VALVES AND VALVE SEATS.

A drill especially adapted for renewing worn out valves and valve seats, without disconnecting the valve from its pipe and without disturbing the pipe, is shown herewith, and has been patented by Mr. George W. Hollingsworth, of No. 643 North Thirty-fourth Street, Philadelphia, Pa. A clamp, of which a face view is shown in Fig. 2, is adapted to be locked around the pipe carrying the valve to be renewed, the valve being shown partly in section, with the outside broken away. The jaws of the clamp are fastened by a washer and nut on a bolt which projects from a collar, the latter being adjustable by a set screw on an upright rod or post, which carries arms held to slide, and fastened by set screws to the upright. In the outer end of the upper arm screws a hollow spindle, operated by a hand wheel, and through the spindle passes a centering shaft, having on its upper end a crank arm, which rests with its hub on the upper end of the hub of the hand wheel, whereby the centering shaft is supported and may be rotated in the hollow spindle. On an enlarged portion of the centering shaft, just above its lower end, and beneath the hollow spindle, is held a dog, adapted to engage a spoke of the wheel of a valve stem, as shown at the left in Fig. 1, this dog being also adapted to engage a second dog or arm held on the stem of a seat-cutting tool placed in the seat of the valve, as shown in dotted lines to the right. On the end of the lower arm carried by the upright rod is fastened, by a set screw, a socket or holder, in which is held a valve cutter, with the usual cutting edges, formed in a central cone-shaped opening, a plan view of which is shown in Fig. 3.

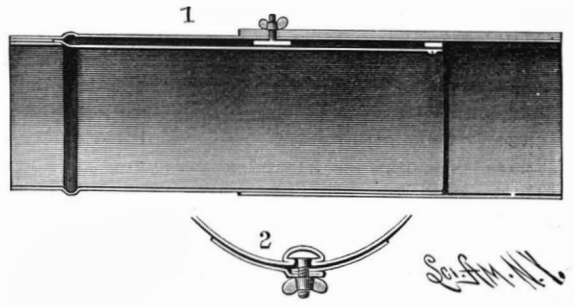
This valve cutter has a central centering opening in its bottom, through which passes the upper pointed end of an arbor held to slide vertically, and resting on a rubber or other spring, which can be raised and lowered by a set screw and held in place by a jam nut. The position of the various parts for the grinding or cutting of a valve is shown at the left in Fig. 1, the centering end of the upper centering shaft fitting on the top of the valve stem, and the centering end of the arbor engaging the lower end of the valve, held in the cutter, when the operator turns the crank arm with one hand and feeds the work downward by turning the hand wheel with the other hand, the elasticity of the spring beneath the lower centering arbor permitting this downward movement. The cutting of the valve seat is represented in dotted lines, the lower arm carried by the upright rod being dispensed with, and the centering end of the shaft operated in the hollow spindle being placed on top of the seat-cutting tool, which is placed in the valve seat. The valve can also be ground into the valve seat by substituting it and its stem for the seat-cutting tool.



HOLLINGSWORTH'S HAND DRILL FOR VALVE WORK.

AN IMPROVED TELESCOPING STOVEPIPE JOINT.

An improved construction of stovepipe joint, by which the pipe can be easily lengthened or shortened and then held in place when adjusted, is shown herewith, and has been patented by Mr. Christian Lehman, of Elgin, Iowa. The section of pipe adapted to enter the other pipe has its edges connected with each

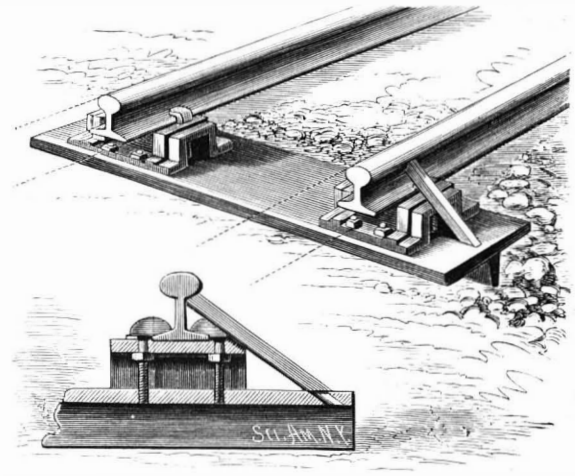


LEHMAN'S STOVEPIPE JOINT.

other by an inwardly curving piece, forming a recess in which the head of a bolt is held to slide, as shown in the sectional view, Fig. 2, the bolt extending outward through a slot and through a seam of the outer pipe, and having a winged nut on its outer threaded portion. The lower end of the recess formed by the inner curved piece, which makes a groove substantially T shaped in cross section, is closed by a stop piece and screw, the stop piece preventing the inner section of pipe from being drawn entirely out of the outer one. The two sections may be drawn out or moved in each other, when the winged nut is loosened, and after they have been adjusted to the desired length the nut is screwed up and clamps the joint.

AN IMPROVED RAILWAY TIE.

A metallic railway tie that is designed to be strong and durable, and one whereby the rail may be supported above the general level of the roadbed, is shown herewith, and has been patented by Messrs. John Moser and Ernst Moeckel, of Ashland, Wis. The bed plate is formed with a central downwardly projecting longitudinal flange or rib, and to its upper face are bolted or riveted two chairs, preferably made from plate metal, rolled to form a central channel, within which the rail rests, the plates being bent downward at right angles to the upper central section, and then outward to form feet. The rails are held to the



MOSER & MOECKEL'S RAILWAY TIE.

chairs by hook-headed bolts, the shanks passing downward through apertures in the chairs to engage with nuts, the lower ends of the shanks entering apertures in the bed plate, as shown in the small sectional view. In order that the rails may be held from spreading, diagonal braces are stepped in the bed plate and rest in recesses formed in the chairs, the upper ends of the braces being of proper shape to fit snugly against the under side of the rail treads. This tie not only supports the rail above the roadbed, but the height of the chairs may be varied to change the height of the rail treads at curves and other places where it is necessary that one rail should be higher than the other.

THE Boston and Lowell, Boston and Maine, and the Boston and Albany have commenced to build round roof cars with satisfactory results. The springing of the roof is a little higher than at present, and the curve is sharp at the sides and flatter on the top, the height of the roof being the same as with the old form. The interior effect is lofty and airy, giving the idea of a very high roof, and the exterior appearance is pleasing.

ON page 292, of last issue, the address of Mr. L. B. Sampson should be Rochester, New Hampshire, instead of N. Y., as stated in the article.

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THE WEISS SYSTEM OF STREET CAR MOTORS.

(*Continued from first page.*)

each possessing a capacity of 125 ampere hours and two volts electromotive force. The plates are contained in hard rubber cells. The cells are at present arranged in series, so that twenty-two, thirty, or forty, according to requirements, can be thrown into action at the same time. This leaves an excess of 20 cells, which may be regarded as a provision for emergencies. With this arrangement, it will be seen that the first twenty-two cells have the most constant work to do, and become most quickly exhausted. It is proposed now to adopt a different style of connection and switchboard, so as to use the batteries in series or in parallel, and thus by varying the electromotive force to vary the power applied to the car.

The switchboards for regulating the battery in any case are carried upon the dashboards of the cars. The driver can turn on more or less current and can shut it off entirely by manipulating the switch handle.

The current drives a five horse power shunt-wound Griscom motor, which is placed under the floor of the car. It has four sets of brushes. By handles worked from the platforms, these can be thrown on and off the commutator drum in pairs, so as to give at will either direction of rotation to the motor shaft. To reverse the motion, the driver has to go to the other platform, as from one platform only one direction of motion can be given.

On the shaft of the motor, which in ordinary running, at eight miles an hour, makes 1,250 rotations per minute, is a pinion. This gears with a larger cog wheel. The latter is mounted on a shaft which extends across the car. The height of this shaft corresponds, as nearly as possible, with that of the axles of the wheels.

As seen in the illustration, an extra pair of wheels is used. These come between the regular ones, and are flangeless. They and one adjacent pair constitute the driving wheels. The shaft turned by the motor carries at each end a friction wheel. A circular friction surface, a few inches less in diameter than the wheels, is provided on the inner side of both driving wheels. The friction wheels, when driving the car, bear against these surfaces. The shaft carrying the friction wheels is fixed in position, and constantly rotates when the motor is in action. To cause it to drive the car, the two pairs of driving wheels are drawn together. To do this, powerful levers are arranged at both ends of the cars, to be operated by the driver. When these are drawn back, the two pairs of wheels are made to pinch the friction roller between their friction surfaces, and consequently rotate with it, thus moviug the car. To allow the wheels to be drawn together, a small amount of play between the pedestals is allowed for. When the lever is released, the wheels spring apart and away from the friction wheel. The amount of this motion is very slight. It need not exceed an eighth of an inch for each pair.

One feature in the history of electric cars has been the trouble incurred in reducing the high speed of the dynamo, whether by belts, plain gear wheels, or worm and pinion. In the present construction it will be noticed that the gearing is not on a wheel axle, and that it is not connected therewith except by the frictional surfaces. This feature, it is claimed, will obviate the wearing strains upon the teeth of the wheels, and avoid the trouble hitherto experienced. Mr. Reckenzaun's recent paper on the subject of gearing for electric street cars very fully portrayed the engineering difficulties of the problem, and gave the different ways in which its solution had been attempted. In the Weiss system a new method of solving the problem is attempted.

The general factors of the car motor and other parts may be thus summarized: The motor is of nominal five horse power, and can absorb from one to 125 amperes at seventy volts electromotive force. Each cell of the storage battery is good for 125 ampere hours in ten hours, at a potential of two volts. Thus twenty-two cells at the normal rate will give 550 watts. But on this car they are used more rapidly, so as to develop from one to three electrical horse power. With thirty cells from two to five electrical horse power, and with forty cells from four to eight electrical horse power are obtained. On average tracks 2,000 watts or 2·68 electrical horse power will drive the car at ten miles an hour. It can turn any curve, the absence of flanges from the center pair of wheels facilitating this operation. It has gone around a curve of 30 feet radius at the rate of twelve miles an hour. It has ascended with a load a grade of between six and seven feet per hundred.

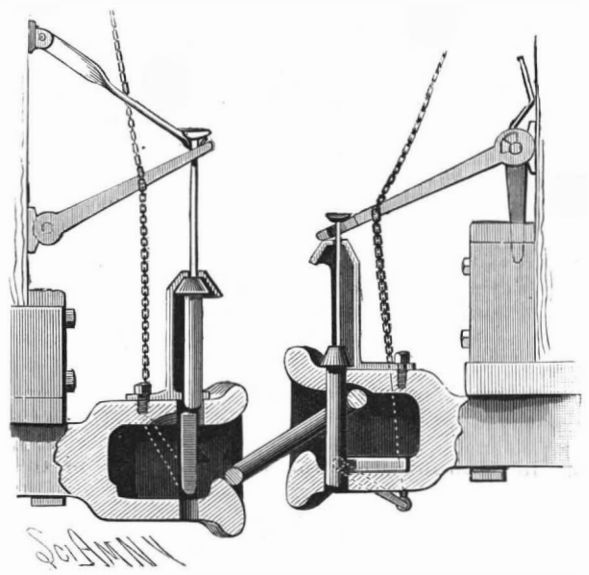
On average running at eight miles an hour it can be used for ten hours without charging the battery. This is based on $5\frac{4}{10}$ hours actual running time at an average of $2\frac{1}{2}$ horse power.

The car with two pairs of wheels weighs 5,200 lb. The additional weight incident to the electrical part is thus divided: The extra pair of wheels with their axle weigh 500 lb., the motor 400 lb., the framing, levers, connecting rods, and other minors parts 250 lb., and the battery 2,100 lb. This gives a total for the extra parts of 3,250 lb.

The bell for stopping and starting the car, the alarm bell for giving warning of the car's approach, and the lamps for lighting the car are worked by the current also. The installation is very complete in these respects. It will be seen that the storage battery is no necessary part of the system, as it is equally well adapted for receiving its supply from overhead or underground leads.

AN IMPROVED CAR COUPLING.

A car coupler which provides a means for retaining the link in suspension outside the drawbar when the cars are in an uncoupled position is shown herewith, and has been patented by Mr. John B. Butts, of Kansas City, Mo. In the bottom of the link opening of the drawhead is pivoted a dog, adapted to rest horizontally when a coupling is made, and to maintain a vertical position beneath the suspended pin when the car is uncoupled, the dog being operated from either the top or the sides of the car by a rod journaled transversely on the car end, and having crank arms at its extremities and a chain connection with the roof, the transverse rod carrying a lever which is in communication with the dog through a chain and arm, as shown in dotted lines. A casing with cone-shaped cap is on the upper side of the drawhead, in vertical alignment with its pin aperture, a vertical rod attached to the pin passing upward through the casing and through a slot in the lever extending from the transverse rod on the end of the car. When the pin is in position in the



BUTT'S CAR COUPLING.

drawhead, as shown to the right, the lever rests substantially on the cap of the casing, and the head of the pin rod on the upper side of the free end of the lever. Above the transverse rod on the end of the car, a twisted arm is pivoted in a bracket, such arm having a recess in one edge and a downward cam-like projection opposite the recess on the other edge. When it is desired to uncouple, and leave the car so that it will not couple with an opposing drawhead, the pin rod, as the pin is raised, comes into engagement with the recess of the twisted arm, the head of the rod resting upon the upper face of the arm, and holding the pin up as shown to the left in the illustration, when the lever by which it was raised may be dropped, carrying the dog in the bottom of the link opening to a horizontal position, and the car will not be coupled by the contact of an opposing drawhead. As the lever is again raised, it comes in contact with the cam-like projection of the twisted arm, and thereby frees the pin rod, allowing the pin to drop into its aperture simultaneously with the drop of the lever.

Running Railway Trains in England.

Among the thousands who travel by rail, there are probably very few who are cognizant of the precautions taken to prevent accidents; nor are the majority of railway travelers aware that under the present system of "running a train," it is almost impossible for a collision to occur except through the negligence of some of the company's servants. In an interesting article on signalmen lately published in a contemporary, the writer explained how the signals were worked; but, according to a railway employe's statement in *Chambers's Journal*, he gives one a very inadequate idea of the care exercised by railway companies to prevent accidents and loss of life to travelers. For instance, we will take an ordinary train at its start in the morning. In the first place, at the commencement of the journey, the engine driver and the fireman belonging to the train, after having "signed on duty"—that is, signed the train book in the shed foreman's office—and being passed by the foreman as fit for work, are required to be with the engine about an hour before the time of starting the train, in order that the driver may satisfy himself that the engine is in proper working order.

His first care is to see that the engine has been thoroughly cleaned, that all working parts are free from grit, and that his previous night's statement as regards repairs, etc., to the engine, has been acted upon; and gets coal and water. He then oils all working parts himself, and proceeds to the station to "pick up" the carriages forming the train. Each carriage has been overhauled by the carriage examiner, whose duty it is to see that the train is all right and fit to proceed on the journey; and where any defect is noticed, the carriage is taken off and sent to the "shops" to be repaired. The train is now within the jurisdiction of the station master, who, having previously seen that the signals and signalmen in his district are in proper condition, at once proceeds to satisfy himself that the carriage examiner has done his duty properly, and notices that the carriages are properly "coupled."

It will be at once easily understood that to prevent oscillation and to secure the easy and smooth running of the train, it is necessary that all the vehicles composing the train should be so tightly coupled as to insure the buffers being brought so firmly together as not to be separated by any change of gradient or by the starting of the train. It is the station master's duty to observe the state of all couplings—including continuous brake couplings and cord communications—and cause any that require it to be adjusted. These couplings are also examined by the guard, who, while in the station, is under the orders of the station master. After the guard has seen that the doors of the carriages are properly closed, the train is ready to start.

The signal to the engine driver to proceed must be given by the guard upon receiving intimation from the station master that all is right. When there are two or more guards with a train, the signal to the driver must only be given by the guard nearest the engine, and then not until he has exchanged signals with the guard or guards in the rear. On the guard rests the chief responsibility for the safe running of the train. How onerous are his duties may be seen from the following. In the first place, he must regulate the working of the train in accordance with the time tables of the line over which he has to run. He must also see that the train does not travel on the line after sunset or in foggy weather without a red tail lamp and two side lamps, which he must keep properly burning throughout the journey.

Every guard when traveling must keep a good lookout, and, should he apprehend danger, he must at once attract the attention of the engine driver. This he does by using the "communication," and also by applying his hand brake, if he has one, sharply and releasing it suddenly. This operation—from the check it occasions—if repeated several times, is almost certain to attract the notice of the driver, to whom the necessary caution or danger signal must be exhibited; and should the train be fitted with a continuous brake with which the guard has a connection, he must apply it until he is certain the driver is alive to the danger. Should danger be first apprehended by the driver, he immediately gives three or more short, sharp whistles, which is a signal for the guard to apply the brake.

If, from any cause, it is found that the train cannot proceed at a greater speed than four miles an hour, the guard must immediately go back one thousand yards, or to the nearest signal box, if there be one within that distance; in which case the signalman must be advised of the circumstance. Otherwise, the guard who goes back must follow the train at that distance and use the proper danger signals, so as to stop any following train until assistance arrives or the obstruction is removed.

When the train is stopped by accident or from any other cause, the guard must go back as before mentioned, and place detonators on the rails at fixed distances, and must not return to the train until recalled by the engine driver sounding the whistle. Should the absence of a signal at a place where a signal is ordinarily shown, or a signal imperfectly lighted, be noticed by the guard, he must treat it as a danger signal, and report the circumstance to the next signalman or station master. These rules, properly carried out, and signalmen and others doing their duty, it will be plainly evident that, although acccidents will sometimes occur, the railway companies do their best to secure the safe working of the line.

Substitute for Gum Arabic.

A substitute for gum arabic, which has been patented in Germany, and is likely to be largely used for technical purposes now that good gum arabic is so scarce, is made as follows, according to the *American Druggist:* Twenty parts of powdered sugar are boiled with 7 parts of fresh milk, and this is then mixed with 50 parts of a 36 per cent solution of silicate of sodium, the mixture being then cooled to 122° F. and poured into tin boxes, where granular masses will gradually separate out, which look very much like pieces of gum arabic. This artificial gum copiously and instantly reduces Fehling's solution, so that if mixed with powered gum arabic as an adulterant, its presence could be easily detected. The presence of silicate of sodium in the ash would also confirm the presence of adulteration.

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The Sunken Treasure Ship at New York.

Over a hundred years ago, the British war ship Hussar, having on board nearly five millions of dollars in gold coin, was sunk in the waters of the East River, in what is now the northeasterly part of New York City. Up to the present time, the raising of the vessel and the recovery of the treasure has baffled the efforts of capable men, though aided by the best appliances of modern science and mechanics. It still remains a task for the genius of the inventor to devise a practical method of solving the problem.

In his opinion in the case of Joseph C. Hartshorne against George W. Thomas, lately filled by Vice-Chancellor Bird, of New Jersey, he tells this interesting story:

The British frigate Hussar, sunk near the city of New York on Nov. 25, 1780, was a 32 gun ship, 206 feet in length, 52 feet 2 inches beam; one of England's proudest ships. She had on board £580,000 in treasure for the purpose of paying the army and navy, they having been without pay for nearly three years. The Mercury also sailed for the same destination with £380,000 of British treasure on board. Its destination was also New York. The Hussar lay at anchor off the Battery two days after her arrival, and during this time the treasure on board the Mercury was transferred to the Hussar, the city then being besieged by an army of "American rebels" and in great danger of capture.

The Hussar was then ordered to sail forthwith to Newport, R. I., and on her way up the East River to the Sound she struck upon Pot Rock, nearly opposite the upper extremity of Randall's Island. An effort was made to land her at Port Morris. When she got within less than 100 yards of the shore, she sank suddenly with all on board, numbering about 150, leaving only the topmasts in view. There were many American prisoners on board, who, being chained below, went down with the ship, and the loss of whose lives created deep feeling of indignation among revolutionary patriots throughout the country. The shore where the vessel went down and where she now lies has nearly perpendicular walls, and at medium tide the water is about 70 feet deep. The whole amount of money on board is estimated at $4,800,000.

In 1794 the British government employed two brigs and labored two summers endeavoring to raise the ship by means of grapples, but without success. It is said they were ordered off by the American government. In 1819 the work was again undertaken by a British company, endeavoring to operate upon the ship by means of a diving bell, the most effective submarine appliance known at that time, but owing to the great volume of tide it was compelled to abandon the enterprise. After this the British government offered a large salvage to induce parties in the States to undertake the raising of the ship. Two or three companies were organized for that purpose in and about Philadelphia and Baltimore, and made the attempt, but without success, owing to the great strength of the tide at all times.

In 1848 Capt. Taylor invented what was called submarine armor, and he was so confident that his invention could successfully operate upon the Hussar that he was induced to obtain personal knowledge at the Admiralty department in England in regard to the amount of treasure. He labored in the undertaking until his death. He willed his invention to his friend, Charles B. Pratt, of Worcester, Mass., with his entire outfit, which he had been three years or more collecting, upon condition that Mr. Pratt should prosecute the work until the treasure was finally obtained, and that he should give one-sixth thereof to his wife and daughter. Mr. Pratt accepted the terms, and was joined in the enterprise by others.

The ship's decks were entirely removed; 26 cannon, large and small, were taken up and sold for $1,500; 4,000 cannon balls, large quantities of rotten cordage, many bushels of gun flints, several leather buckles with the name Hussar on them, which may be seen at the historical rooms in the city of Worcester; many human bones and skulls, manacles, and chains, glass, earthen and pewter ware, the ship's bell, and hundreds of articles usually on board of a war vessel, most of which are still in the custody of the company.

Mr. Pratt and his friends continued the work until 1866, when individual interests had been divided, subdivided, and resubdivided and the fractions scattered far and near. With a great deal of trouble the several interests were collected and a company incorporated under the laws of New York, with a nominal capital corresponding with the amount of treasure the Hussar was supposed to contain, and divided into 48,000 shares of $100 each, and known as the Frigate Hussar Company. This company worked with more or less success after that time.

An effort was made to get the submarine company which operated on the steamer Golden Gate, lost on the Pacific coast, with $1,000,000 in gold on board, to operate on the frigate Hussar, but it does not appear that that effort was successful. It is in evidence that from 1857 to 1880 there were continuous efforts made by different interests to reach and raise the Hussar or to lift the buried treasure from her hulk. Although he had commenced searching for the prize in 1879, in 1880 George W. Thomas, the defendant, being influenced by a stronger desire to exhume this treasure and by a strong conviction that it could be accomplished, secured permission from the government to proceed, and solicited aid from his friends for the purpose of carrying on the enterprise. Money was advanced to him by them. On the receipt of money he acknowledged it, and gave them a stipulation agreeing that he would, as soon as he recovered the treasure, "pay to said —— the sum of $——, with no delay more than will be necessary to convert the same into lawful money of the United States." The complainant advanced to the defendant $5,000 in the first instance, which was acknowledged by the signing of such a receipt. This was upon February 16, 1882. On March 2, 1883, he advanced $5,000 more on like terms. In May of the same year he advanced $3,000 additional, which last sum the complainant insists was upon the same representations and for a like purpose, but which the defendant insists was loaned to him upon his own personal security, together with a chattel mortgage on the scow in use at the work, and without any reference to the enterprise of raising the buried treasure.

The enterprise thus begun by Thomas was carried on until January, 1884, when his supporters became discouraged, sought to call him to account, and failing that, they formed a company for the purpose of carrying on the work themselves. They succeeded in having the government annul all obligations between it and Thomas. His property was attached, and when the proceedings were settled, the chattel mortgage alluded to was enforced and all his appliances were sold. No part of the money advanced by the plaintiff has ever been repaid, except what was realized from the sale under the chattel mortgage.

The bill in this case asks that the contract made by the defendant with the plaintiff and others be specifically performed; that a receiver may be appointed to take charge Thomas' property, and that the defendant account for all the moneys received by him to raise the sunken treasure. The vice-chancellor refuses every part of the application except that calling upon the defendant to account.

"It is just to say," says the vice-chancellor, "that I can discover nothing which tends to the conclusion that the defendant, Thomas, attempted in any sense to mislead. That the accomplishment of the undertaking was certain in his mind is very plain. He undoubtedly believed that he would be successful, and he made every reasonable effort to convey this conviction to the minds of those from whom he sought pecuniary aid. It would not perhaps be departing from the truth to say that his expressions were over-confident, and that cautious men—men not given to speculation or fond of pursuing chimeras—would not have entertained his propositions. Most probably such men would have spurned them, and would have found his convictions utterly baseless in the immense reward that was offered for the loan; that is, $37,500 for the advance of only $5,000. But it is not the first time that a shining hook has been grasped to be followed by mortification and loss."

The International Hygienic Congress.

The session of the International Hygienic Congress at Vienna was closed on October 2, when it was finally decided that the next session should be held in London, in 1891. The meetings were remarkably successful, and did much to enlighten the public as to the nature of the questions which are now being discussed by students of hygienic laws. On Wednesday, September 28, interest was centered chiefly in the third section, where the circumstances under which cholera is disseminated were considered. Prof. Max Gruber, of the Vienna University, who gave an account of the incidents of cholera in Austria during the years 1885–86, stated that he could find no evidence of water having played any part in disseminating the disease during that period. He believed that cholera was disseminated by human intercourse, and this experience, he said, coincided with that of English observers. On the other hand, Dr. Spattuzzi, of Naples, attributed the absolute immunity from cholera enjoyed by Naples during 1885–86, and the comparatively small extent of the disease during the present year, to the excellent water supply provided in 1884. Prof. Pettenkofer made some interesting statements on the influences which, in his opinion, locality and season have on the spread of cholera. In support of his views he referred to experiences in India, where each province has its own time of year when the disease is more prevalent, but he also freely admitted the effects of pilgrimages and fairs in spreading the disease. In the course of the debate Prof. Pettenkofer again took occasion to pay a high tribute to England for the measures adopted for the prevention of cholera, and M. Proust, of Paris, expressed himself in the same sense. Thursday was devoted to excursions and the visiting of public institutions in Vienna. On Friday, Sir Douglas Galton, who presided over the first section, offered some valuable remarks on the treatment of infectious fevers. He showed that in London much had been done by the system of isolating small-pox and scarlet fever patients quickly, by taking them to a ship hospital or to hospitals remote from dwelling houses. "But it is most undesirable," he added, "that in these isolated hospitals too many patients should be concentrated in one ward. The principle should be smaller wards, of four to six patients at most, and great simplicity of construction with ample aeration." Sir Douglas expressed the opinion that the bodies of patients who die of infectious fevers should be burned, and in this view he was supported by Sir Spencer Wells, who said that the good done by giving the people pure air and water, wholesome food, and proper dwellings must to a large extent be counteracted by the continual presence of thousands of putrefying bodies in and around centers of population. Much interest was excited by the proceedings of the third section, when the question of preventive inoculation against rabies was discussed. At the final meeting, the usual votes of thanks were passed, and Prof. Ludwig, the president, said that all the objects of the congress had been attained. Dr. Roth, of London, expressed a hope that the "protectorate" of the next congress would be undertaken by the Prince of Wales.—*Nature.*

Remarkable Efficiency of Improved Brakes.

It will be remembered that it was suggested last May that a proper supplement to the Burlington brake tests would be the running of a train a long distance, with varying conditions of grade, track, and weather. Something of that kind the Westinghouse company has now undertaken with its peripatetic school of braking. The journeys of its 50 car train, fitted with its latest improvements, seem to be something in the nature of a triumphal progress, or, at least, will pass as one until some competitor can make a more brilliant showing. The aim in these last illustrations of the efficiency of the air brake seems to have been to use it under actual working conditions as to leverage and pressure, rather than to make the quickest possible stops. At the tests at Como (near St. Paul) emergency stops down a grade of about 31 ft. were made in 172 ft. at 19 miles an hour, in 200 ft. at 20¼ miles, 490 ft. at 36 miles, and 583 ft. at 37 miles. At Chicago, on level track, the stops were 164 ft. at 20 miles, 184 at 22 miles, 469 at 40, and 487 at 37 miles an hour. These were with a 50 car train empty. With a 20 car train, the stops at Como were 109 ft. at 20 miles and 327 at 37 miles. At Chicago they were 120 ft. at 20 miles and 272 at 33 miles. The reports received show that there were no injurious shocks, and with the 50 car train no skidding. With the 20 car train, greater leverage was used, and the wheels were skidded more or less. The time required for complete application of the brakes on the 50 car train is stated as before as two seconds, and the time of release at the thirty-fifth car 25 seconds. These results are of the greatest importance, as showing that trains can make such stops without shock and without the aid of electricity, but they only confirm the knowledge gained in the recent private trials at Burlington. They have been seen, however, by a great number of people, and will carry conviction. One most remarkable episode of the journey to St. Louis was a stop not in any programme. The train was flagged while going 52 miles an hour on a 63 ft. grade, and was stopped in less than half its length—that is, in less than 950 ft. The train comes east by Cincinnati, Cleveland, and Buffalo, and later will go south. It will be surprising if at the end of its wanderings the sum of human knowledge about air brakes is not a good deal increased.—*Railroad Gazette.*

The Northwestern Gold Fields.

Dr. Dawson, Assistant Director of the Geological Survey, who headed the party sent by the Dominion government to explore the country adjacent to the Alaska boundary, has returned to Victoria. Two of his party, Messrs. Ogilvie and McConnell, will winter in the district, making astronomical observations, which will give data for the establishment of the international boundary. The exploration so far has secured a great deal of geological, geographical, and general information of the country, and indicates that it is far from being the Arctic region it is sometimes represented to be. The point from which the Doctor turned back was at the junction of the Lewis and Pelly Rivers. It is 1,000 miles north of Victoria. There the flora was found to differ but little from that on the banks of the Fraser. A great deal of open, grassy country exists along the streams tributary to the Yukon. No areas of tundra or frozen swamps, such as are to be met with in the interior of Alaska, were discovered by the expedition. The Doctor's conclusion is that the whole country from Cassian to the vicinity of Forty Mile Creek, on the Yukon River (which must be near the eastern boundary of Alaska), yields more or less gold in placer deposits. This would constitute a gold-bearing region fully 500 miles in length by an indefinite width, and which, so far, in comparison to the area, has been very little prospected.

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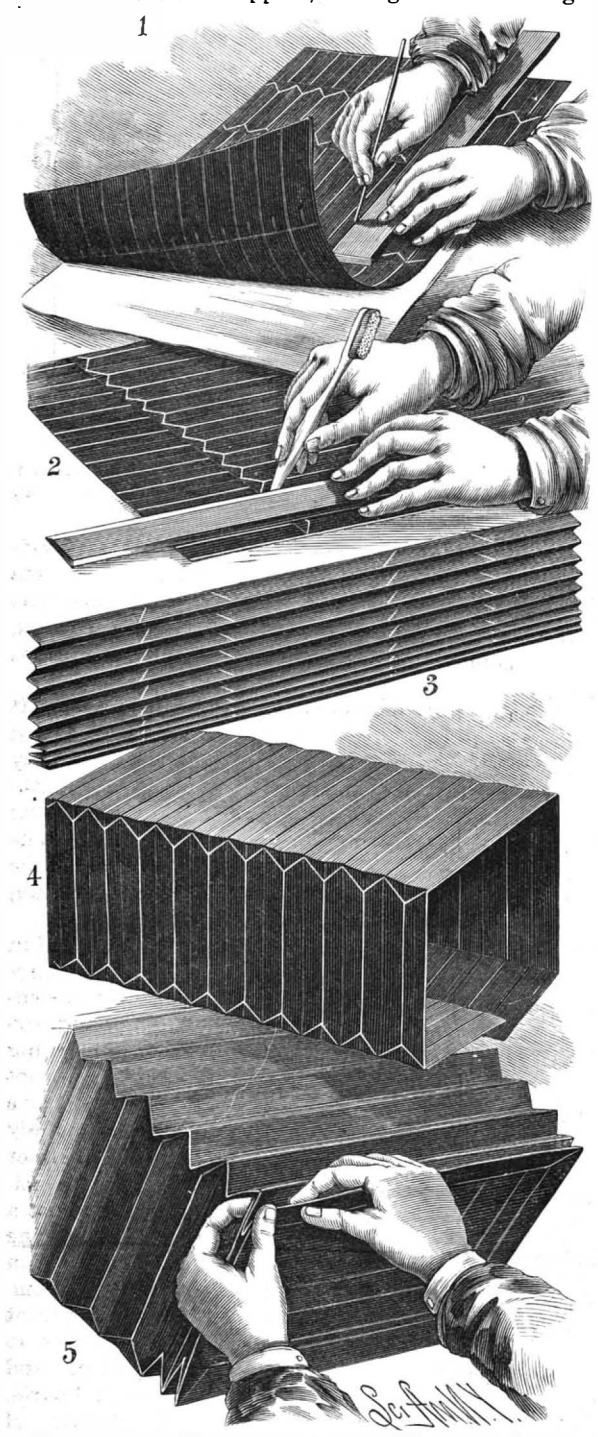
HOW TO MAKE A CAMERA BELLOWS.

In manufacturing photographic apparatus on a large scale, as is now necessary to meet the rapidly increasing demands of the amateur and professional photographer, very little care is taken by some manufacturers to critically test the light-tight qualities of each camera and bellows. Hence it happens that the purchaser sometimes finds, after careful trial, that he has obtained a faulty instrument, which, in these days of quick plates, is especially aggravating. A tight bellows is the most important feature about a modern camera, and it will be the purpose of this article to describe how one can be easily made. Leather, in some countries, is preferred to any other material, but the inferior qualities frequently used for the purpose are affected by moisture and become brittle, and will break at the corners in a short time. Rubber-coated cloth is largely used, on account of its imperviousness to moisture, but has the disadvantage of softening and sticking in a prolonged heat, particularly when the air is very humid, as it sometimes is in the United States, which results in the formation of minute interstices in the cloth support, through which the light will leak. Besides this, it is heavy and will break at the corners.



Figs. 1 to 5.—CREASING AND FOLDING THE BELLOWS.

Mr. Edward Bierstadt, of this city, formerly an amateur photographer, noticing the several weak points in camera bellows, concluded to try paper as a substitute for the above named materials, which proved to be so satisfactory after ten years' use that he has now adopted it exclusively. For large sized bellows a heavy grade of the best calendered Manila paper is advised, since it is tough and pliable, but for small cameras a Japanese paper, commonly called "Japanese leatherette,' should be used, as it is remarkably tough, and is a perfect imitation of leather.

By using black paper the blackening of the inside of the bellows may be omitted.

Two forms of bellows, either straight or conical, as to their length, may be made, but that of the straight shape is the easiest to make, which we will first describe.

It is advisable that a model of the bellows be first planned out on a thin sheet of paper, then creased and folded, in order that one may become familiar with the peculiarities of the folds and the way of folding.

In calculating the size of the sheet required for a given length of bellows, allowance must be made for the extra length taken up by the folds. If a bellows is to be constructed for a camera adapted for 5 × 8 pictures, and it is desired that it have a stretch of fifteen inches, a sheet of paper 29 inches long by 15 inches wide should be selected. For this purpose we recommend a black leatherette paper, to be had from manufacturers of book binders' materials.

A yellow pencil should be used, so that its mark may be easily traced on the black paper, and a sheet of transfer paper, with one side rubbed over with chalk, as large as the bellows sheet, should also be provided.

The principal points to be observed in planning the bellows is to calculate where the outside and inside folds will come and what portions of such folds are to be creased from the inside and outside.

To ascertain these several positions on a flat piece of paper and properly locate them, so that the folds will all come together in unison when the bellows is formed, is the problem one has to first study.

Diagram A illustrates the method of outlining the sheet with measurements for a 5×8 bellows. The sheet, being bent around in the direction of its length to form the bellows, requires that the lines representing the four angles of the bellows be drawn at right angles to the line of the folds, or parallel with the shortest length of the sheet. Two parallel lines are first drawn, 8¼ inches apart, equally distant from the center of the sheet, at right angles to its longest length. Then 5½ inches equidistant on the outer side of these lines two other parallel lines.

These four lines represent the extreme four corners of the bellows, which, for convenience, we will call corner lines. They are creased from the inside. The bottom side of the bellows is divided, and an allowance is made for the lap. As the width of each side of a fold of the bellows is to be ¾ of an inch, we next proceed to draw parallel lines, ¾ of an inch apart, across the longest length of the sheet, as shown by the heavy lines in the diagram, commencing ¾ of an inch from the edge. These represent where each fold is to be made, which we will term fold lines.

To find where the corner folds are to come, we next draw four lines, parallel with the first four corner lines, two of which are ¾ of an inch distant from the outside of the two center corner lines, and the other two ¾ of of inch distant inside of the two outer corner lines. When so drawn, we have a series of ¾ inch squares made with respect to the corner lines and fold lines, the squares lying toward each other, on each side of the corner lines. Starting from the edge of the sheet, we now intersect each square with a diagonal line, carrying it outward from the two center corner lines and inward from the two outer corner lines. In the second square the reverse direction is taken. Thus we find the proper location of the corner folds by intersecting all the squares.

Having laid out the location of the folds, the next step is to ascertain which lines are to be creased from the outside and which from the inside of the bellows. Those to be creased from the inside are indicated by open or double lines in the diagram, while the heavy lines are to be creased from the outside.

Fig. 1 in the large engraving shows the manner of transferring the lines to be creased on the inside to the underside of the black sheet. The latter is laid upon a sheet of chalked paper, and with a rule and metal point the double lines drawn on the upper side of the sheet are run over. The pressure of the point is sufficient to leave a distinct white line on the under side of the sheet.

Fig. 2 illustrates the way the lines are creased, which may be done by drawing and pressing the point of a tooth brush handle or a carpenter's square lubricated with paraffine wax over the lines. First the side intended to form the outside of the bellows is creased, then the other side.

The sheet is folded up, after creasing, as shown in Fig. 3, and tightly compressed, which gives the folds a definite, fixed form. The sheet is next drawn out flat and folded transversely to its length at the four corner lines, as shown in Fig. 4, and the lap of a quarter of an inch at the bottom is cemented by glue or mucilage. A simple way to glue the joint is to first secure one end of a long, flat stick in a vise and then slide the bellows over it, allowing the lap to rest on the stick. A slight rubbing pressure on the paper will bring the previously glued surfaces into close contact and make a permanent light-tight joint. When the joint is perfectly dry, then the bellows is formed, as shown in Fig. 5, by commencing at the corners, and gradually crumpling and bending in the creased portions, continuing the manipulation on each corner of each separate fold one at a time. It is surprising to notice how readily the folds harmonize in with each other, provided the sheet has been carefully creased. To render the bellows waterproof, it is varnished on the outside with two coats of shellac varnish. When secured to the front and rear frames of a camera box, we have a waterproof non-crackable bellows which is absolutely light-tight, tough, and capable of being very compactly folded up. If light-colored paper is employed, the interior of the bellows should be blackened with a varnish composed of shellac and lamp black. If the shellac is dissolved in water, borax or ammonia must be added to make the shellac dissolve.

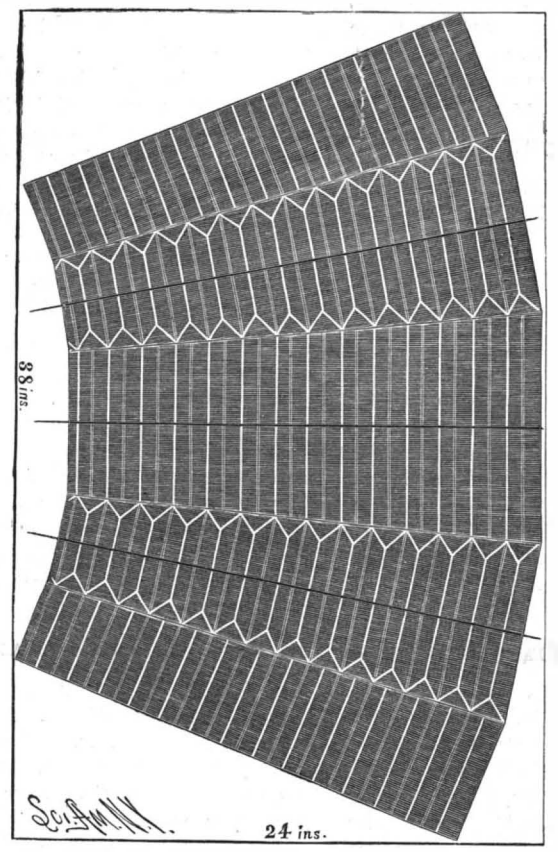


Fig. 6.—PLAN OF AN 8×10 TRUNCATED PYRAMIDAL BELLOWS.

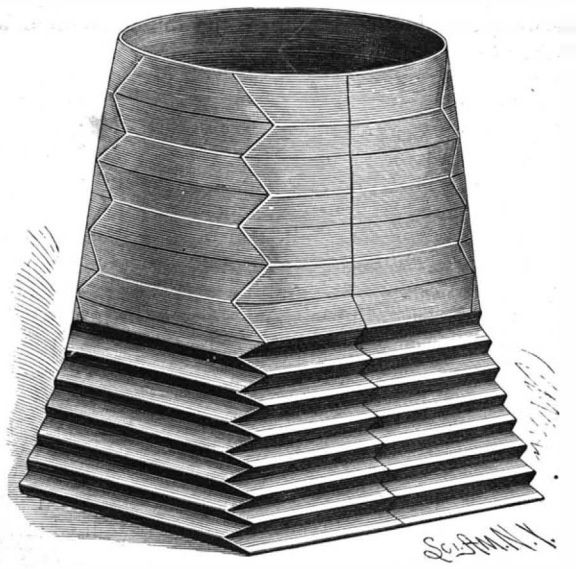


Fig. 7.—TRUNCATED CORNERED PYRAMIDAL BELLOWS.

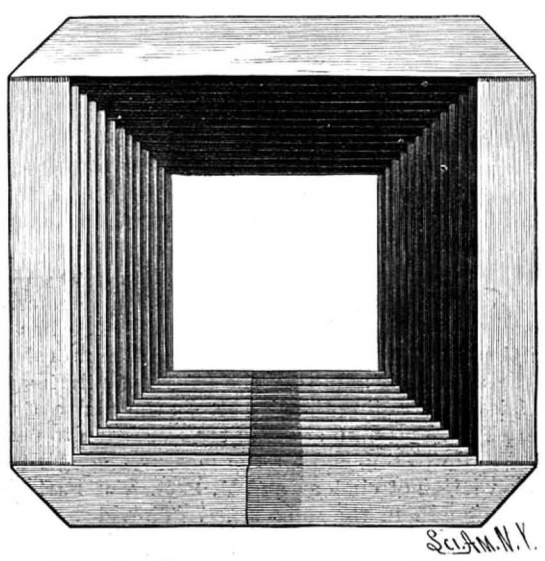


Fig. 8.—BACK OF TRUNCATED CORNERED PYRAMIDAL BELLOWS.

In making a truncated pyramidical shaped bellows, the plan of laying out the lines for creases and folds is quite similar to that previously described, with the exception that special compensation for the gradual tapering of the bellows has to be calculated for. The width of one-half of the folds is proportionately narrower than the other half.

In Fig. 6 is seen the plan of an 8×10 bellows, in which the solid white lines represent the crease lines for the sunken folds on the outside of the bellows, and the double lines the crease lines for the under or inside folds. The size of sheet required is 24×38 inches.

We first draw a center line in the direction of the length of the bellows, then, supposing the back of the bellows to measure 10½ inches, and the front end 6¾ inches in width, we lay off half of this measurement on

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each side of the center line and connect the ends of the two front and back cross lines. These oblique lines form the two upper radial corner lines of the bellows.

Supposing the sides to measure 8½ inches wide on the back and 4¼ inches on the front or small end, we divide the distance at each end and locate the side center lines (see Fig. 6). From these we determine the location, by measurement, of the two lower radial corner lines of the bellows. The bottom of the bellows is then divided, and one-half added to each side of the

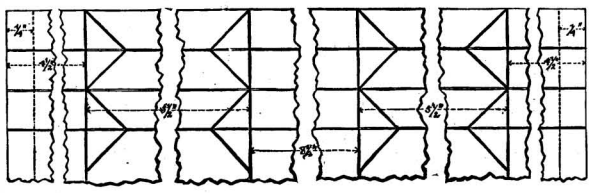

DIAGRAM A.—MEASUREMENTS FOR A 5×8 BELLOWS.

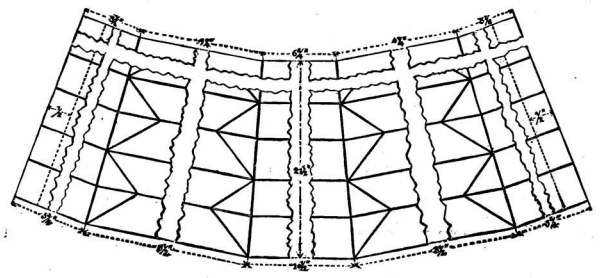

DIAGRAM B.—PLAN AND MEASUREMENTS FOR AN 8×10 BELLOWS.

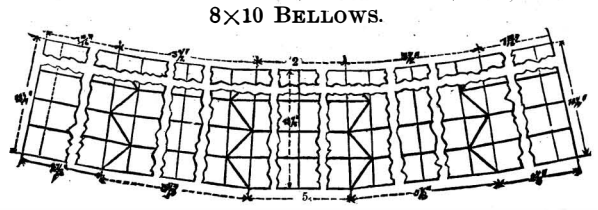

DIAGRAM C.—MEASUREMENTS FOR A 4×5 TRUNCATED CORNERED BELLOWS.

sides of the bellows, an extra length of ½ an inch being allowed for the lap or joint.

The crease lines for the cross folds are next determined, by first dividing off on the respective center lines in equal distances the width of a double fold, which may be about 1½ inches. The measurement should commence from the wide end and proceed toward the small end. Cross fold lines are then drawn between the four radial corner lines in each section, at right angles to their respective center lines, and will meet each other, producing a shape similar to a portion of an octagon. The next step is to locate the position of the intermediate fold. This is done by laying the base of a draughtsman triangle on the base line, or back of line, and drawing a line at 45 degrees inward from the intersection of the corner line with the back line, nearly across the fold, then by reversing the position of the triangle, so that its base is coincident with the next fold line, and drawing another diagonal line at 45 degrees inward from the intersection of the fold line with the radial corner line to where it will cross the other diagonal line. Where they meet will be the proper location of the intermediate fold line. This will be the same for all the intermediate folds. The points for these lines should then be located on the center line, and they should be drawn parallel with the other fold lines between the two center corner lines. Each side of the bellows is measured off in the same way. The corner folds are located precisely as in the case of the rectangular bellows, by drawing lines ¾ of an inch distant from the corner lines parallel with the latter, and crossing the squares so formed by diagonal lines, which represent the zigzag lines of the corner folds. Fig. 6 and Diagram B show positions of these lines. The double lines are to be creased from the inside.

One slight objection to this form of bellows is that it is liable to stick and not to freely expand. Hence Mr. Bierstadt has devised a simpler shape, in which the corners of the folds are truncated. This form is clearly shown in Figs. 7 and 8.

The bellows, by its peculiar construction, may be folded up more compact than any other, and at the same time is so elastic and springy that its folds do not in the least adhere or stick to each other. In Fig. 7 we see the conical shaped sheet after it is creased and cemented, in the process of being changed from the round to the square shape. After the flat sheet is creased, its ends are glued together, which forms a truncated cone. Then it is compressed at the creases into folds, as shown in Fig. 5.

Fig. 8 shows the peculiar corner fold of this bellows, the joint at the bottom, and its compact form when compressed.

Diagram C shows the plan and measurements of a bellows adapted for a 4 × 5 camera, as shown in Figs. 7 and 8.

The special difference in creasing from that shown in Fig. 6 and Diagram B is in the corner folds, which is explained more clearly by referring to Diagram D.

Supposing the inside measure at the back to be 5 in. and at the front 3 in., we locate a center line, C, and lay off the side corner line, D, as heretofore stated. We then divide the center line into inches, and draw lines parallel to A, extending them on each side as far as side line, D. We next determine the position of the intermediate line, I, by deducting from half the distance between E and A the amount of space between G and H, obtained by dropping a line from the intersection of fold line, E, with corner line, D, to the base line, A, the said line, E F, being parallel with the center line, C. Just here is an important difference. Instead of stopping the intermediate line, I, at the corner line, D, we extend it to point, J, or a distance beyond the perpendicular line, I F, equivalent to the space between I and F or between E and I. We then draw the line, J, parallel with corner line, D, and have a guide where to draw the zigzag line, since the intermediate lines like I extend to line, J, and the inner fold lines, like A and E, to line, D. By drawing a diagonal line from H to J across the square, K, and from J to E across the square, L, we have the proper location and angle for the corner crease lines. From the point H, we measure off half of the width of the inside of the intended side of the bellows. Draw a center line perpendicular to its base, and measure off on that the position of the fold lines as described for the top of the bellows. It will be seen that on the sides of the bellows the intermediate lines stop at line, J, while the other fold lines cross the line, J, and meet at E. By this method a curious skew shape of the cross lines, especially between lines, D and J, is observed, but is necessary in order that the folds may come out in unison.

A bellows constructed after the above plan presents a very neat and light appearance. It requires a little more paper, but is, by reason of its elastic qualities, almost self-acting. It should be remembered that the use of dividers must be avoided, since the slightest puncture in the paper will damage the bellows. Working plans of the different forms of bellows will shortly appear in the SCIENTIFIC AMERICAN SUPPLEMENT.

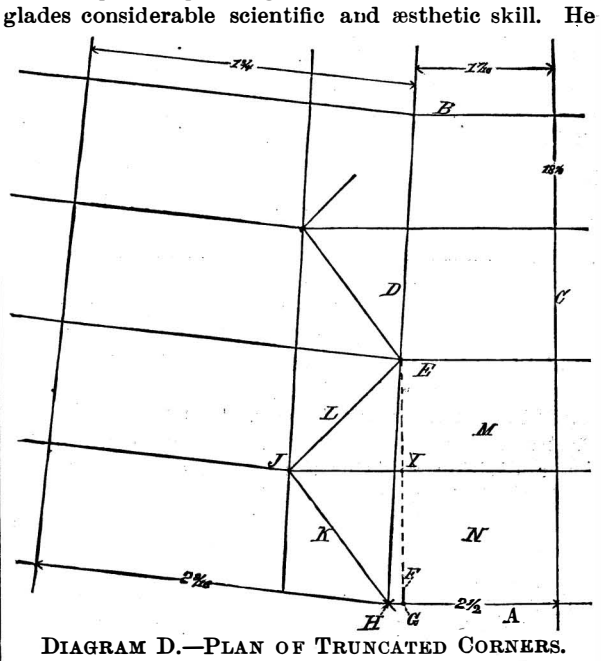

DIAGRAM D.—PLAN OF TRUNCATED CORNERS.

SARGENT'S PALM. (*Chamæphenix Sargentii.*)

For many years the royal palm held court as a small family of nobility on the southernmost extremity of southwestern Florida, at Cape Sable. These few examples were all that were known to belong to the United States, as a native growth. The small grove was a place of resort for lovers of the curious and interesting in nature, but the vandal hands of some of the too rapidly increasing bands of hunters and tramps long since carried off every vestige of the wood from these beautiful vegetable forms.

It was with great pleasure that we learned from Mr. Monroe, of Staten Island, that he had discovered several of the grand trees on a piece of timber which he had purchased near the Miami River. Mr. Monroe was an early purchaser in this region, and adds to his enterprise in planting the new lands near the Everglades considerable scientific and æsthetic skill. He penetrated the thickets in all directions, and with photographic implements in hand he secured the pictures of all notable objects.

It was with surprise that he came upon several handsome palms, differing wholly from those which are familiar to the visitor there. He readily decided that they were royal palms, yet their low and outspreading foliage struck him as differing from those glorious trees.

The habitat of these palms is so difficult of access, it is scarcely strange that they have never before been seen. Elliot's Key is another and more recent locality of these palms, lying about eight miles off the southeastern coast of Florida, forming with Arsenicker Keys the southern boundary of Biscayne Bay. The island is about seven miles long and about a half mile wide. Here the very successful experiment of raising pineapples is being repeated with profit.

In 1886 Prof. Sargent, of Cambridge, was engaged in examining the botany of the region. Here the proprietor, Mr. Filor, led the party to what was considered a group of young royal palms. On observing the fruit, which was not fully matured at the time, it showed plainly that it was of a distinct species, and new to science. As there are about a thousand species of the palms, their identification is not always easily accomplished. Prof. Sargent sent a specimen of this tree, in the form of its fruit and some other essential parts, to Prof. Wendlandt, of Germany, who has great facilities for the study of such plants. It was found that the newly discovered tree was not only different in species, but in genus also. Hence the Professor has named it *Chamæphenix Sargentii*. The first or generic name denotes its resemblance to the date palm.

Prof. Sargent first visited these trees in April, when the fruit was not yet ripened. He thinks that the tree flowers in September, and that the fruit ripens in June—when it is about the size of children's marbles. The fruit is borne mostly in twos and threes, the thin, smooth pericarp incasing one, two, or three spherical nuts. The ber-

A NEW PALM—SARGENT'S PALM (CHAMŒPHENIX SARGENTII).

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ries of the royal palm are scarcely larger than buckshot. This new tree reaches about twenty feet in height.

Mr. Monroe informs us that the Messrs. T. & E. A. Hine, of Woodside, N. J., owners of a large cocoanut grove in the western end of Long Key, while prospecting came across "quite a large grove of what they took to be the royal palm," rather stunted in growth, as they thought, by the winds. It seems that Mr. Monroe was suspicious that the tree was not a true royal palm, as he was familiar with both, having found on Little River several specimens of what now prove to be new. He transplanted several, and up to lately they were doing well. Should these new trees prove hardy and easily propagated, they will be a valuable addition to the semi-tropical flora of the United States.

That they stand quite low temperatures is seen by the fact that in the winter 1875–76 the mercury at the above localities stood at 36°—a point much lower than ever known there before.

We are indebted to A. H. Curtiss for some items of interest connected with the discovery of this new tree, he having accompanied Prof. Sargent as a botanical guide to the Florida flora.

A New Compass.

The *Alta California* gives an account of the test of a new compass invented by Leon Sirieix, a Frenchman by birth, and a graduate of the French Polytechnic. The compass as exhibited consists of a brass cylinder divided into two compartments. The lower compartment contains the corrector of the needle, while the upper division contains the compass card, which is swung on a pivot, as in the ordinary compass. On one side of the cylinder, close to the base, is a screw, and in the center of the base is another. These are the adjusting screws, the first, A, being used for correcting the permanent magnetism, and the other, B, for the correction of the induced magnetism. The inventor placed his compass on an imaginary ship, and laid her head due north, or in other words, made the "lubber line" form one with the pole on the wall. The needle then pointed due north. On the other courses the same result was attained. The needle never deviated one degree from the north. Iron was placed around the compass, and the needle was observed to deviate a degree west. The inventor moved screw, B, and adjusted the needle carefully. The imaginary vessel was swung again, and on every course the needle pointed due north. It was also shown that the compass had no "heeling error," which is caused by the rolling of the vessel. A most severe test was applied, but the card remained perfectly horizontal. The Sirieix compass was revolved at a great rate, much more than could ever be attained in swinging a ship, and directly the motion was stopped the compass card was seen to be still pointing north, and it had moved little more than half a degree on each side of the "lubber line." The compass card was spun round at a great rate. Left to itself, it became dead in about one minute's time. An ordinary compass would revolve probably five minutes or more. Mr. Sirieix has in his compass avoided the use of compensating magnets placed in the deck or binnacle, vertical bars, and other arrangements necessary to the compasses mentioned. He has, to use his own expression, "centralized and neutralized" the magnetism of the ship in a spot directly beneath the compass card, thus succeeding where others have failed. The *Alta* says: "Prof. Sladky, of the University of California, has testified in writing to the splendid performance of Mr. Sirieix's instrument, and it has also been examined by Lieutenants J. B. Milton, E. J. Dorn, and G. M. Stoney, of the U. S. Navy, all of whom agree as to the efficiency of the compass."

Spanish Naval Progress.

The United States government has at last screwed up its courage to the extent of ordering ships that shall make 19 knots an hour. This is equivalent to being about a quarter of a century behind old Spain. The Spanish navy is now in possession of a war vessel, the Reina Regente, that sails at the rate of 21 knots per hour. Probably by the time our 19 knot ships are ready, Spain and other nations will have vessels that can make 25 knots. It seems to be difficult for our Navy Department to keep posted as to what is being done by other naval powers. What is the use of building antiquated, slow boats, when better and more approved forms are already afloat that can sail around them and run them down.

The Reina Regente has a displacement of 5,000 tons, 12,000 horse power, burns 1·4 pounds of coal per hour per horse power, and has a very formidable armament. This wonderful vessel was built in 15 months' time. The fastest torpedo boat is also in the Spanish navy. It is named the Destructor, and runs at a speed of 22½ knots or over 26 miles per hour.

Spain is rapidly regaining her ancient prestige on the sea. Spanish steamship lines are fast being extended all over the world. Splendid Spanish steamers now ply between New York, the West Indies, and Mexico. On the Pacific the Spanish steamers are vigorously competing for the coast trade.

Gas Lighting.

The first really authentic record of experiment on the destructive distillation of coal for the production of illuminating gas occurs in a work by Dr. Stephen Hales, published in the year 1726. In it he says that from the distillation of 158 grains of Newcastle coal, 180 cubic inches of gas (or, as he says, "air") could be produced. In the year 1792, William Murdoch, of Redruth, in Cornwall—a Scotchman by birth—experimented on the gas produced by the destructive distillation of various animal and vegetable substances, though it does not appear that he used any other means of purifying the gas than water. Upon the occasion of the national illumination at the peace of Amiens, on March 28, 1802, he lighted up a portion of Messrs. Boulton & Watt's factory at Soho, near Birmingham, with a public display of gas lights; and this is probably the first practical attempt at gas lighting upon a tolerably large scale. He afterward extended the apparatus so as to give light to the principal shops in the neighborhood; and in 1805 he fitted up plant for lighting Messrs. Phillips & Lee's cotton mill.

But we, as a nation, are not to bear the whole honor of introducing gas as an illuminating agent, for in 1799 Lebon lighted up his house in Paris with coal gas, much to the astonishment of the people; and Mr. F. A. Winsor, happening to be at Brunswick at the time the experiments were made known, was much interested, and forcibly struck with the vital importance of the results. On his return to England shortly afterward, he endeavored, by a series of popular lectures which he illustrated by suitable experiments, to overcome public prejudice, and advance the general adoption of coal gas as an illuminant.

After many unsuccessful attempts, Winsor succeeded in forming a company in the year 1810, when an act of incorporation was obtained under the title of "The Gas Lighting and Coke Company;" the royal charter, however, not being granted till the year 1812. But from that time to this the use and manufacture of gas for illuminating, domestic, and manufacturing purposes has steadily and enormously increased, till at the present day it forms the center of one of the most important and profitable of the industries which invariably accompany the triumph of civilization and science over the dark mist of ignorance and superstition.—*A. C. Wilson.*

Magnesia.

Dr. Frank, of Charlottenburg, refers to the previous experiments of Vicat, Macleod, and Deville, who had noticed the possibility of employing magnesia as a cement, but it was not until the need of finding some use for the enormous quantities of refuse magnesia salts, arising as by-products in the manufacture of potash at Stassfurt, that the subject again recently attracted attention. The question is of all the more importance in that the other compounds, the chlorides combined with the magnesia at Stassfurt, are valuable for the production of bleaching powder and hydrochloric acid. When Sorel pointed out, in 1867, that a cement could be produced by mixing chloride of magnesium and magnesia, it was hoped that good results would ensue. The composition of this cement was based upon much the same principles as the white stopping used by dentists, made of zinc oxide and chloride of zinc. This cement of Sorel, in spite of many attempts to use it, proved a failure in consequence of a tendency, often noticed also in calcareous cements, to swell and blow, owing to deferred hydration. Dr. Grundmann, of Hirschberg, has recently patented a new method of treating the magnesia, for whereas formerly the material was merely calcined and made up with water, he now carefully slakes the calcined magnesia, and subsequently exposes the compound or casting to the action of carbonic acid gas, much in the same way that builders have been in the habit of drying and hardening plastered rooms by confining the air and burning coke in them, so as to liberate carbonic acid gas. The natural carbonate of magnesia, known as magnesite, is a mineral of great hardness and density, and the similar substance obtained by the above treatment resembles magnesite in its hardness and in its capacity for taking a good polish. Grundmann also employs the magnesia as a cementing agent for various materials, for instance, by the use of marble dust an artificial dolomite is obtained. The magnesia can also be improved by adding to it soluble silicates of the nature of water glass, and it can be used as a stucco for building purposes.

Liability of the Telegraph Company.

A lumber dealer in Bangor, Me., delivered to the Western Union Telegraph Company at that city, for transmission to his correspondent in Philadelphia, the following message: "Will sell 800 M laths delivered at your wharf two ten net cash. July shipment. Answer quick." The message as delivered in Philadelphia omitted the word "ten," making the price read "two net cash." The offer contained in the telegram was accepted immediately by telegraph. The laths were shipped at the price named in the telegram as delivered, viz., two dollars per M, and the Bangor dealer brought suit against the telegraph company to recover for the loss sustained by him. The company relied, among other things, upon a stipulation printed on the blanks to the following effect: "It is agreed between the sender of the following message and this company that said company shall not be liable for mistakes or delays in the transmission or delivery or for non-delivery of any unrepeated message, whether happening by negligence of its servants or otherwise, beyond the amount received for sending the same." The company also urged that the plaintiff was not bound by the erroneous message, and need not have delivered the laths to his Philadelphia correspondent. The Supreme Judicial Court of Maine (Ayer vs. Western Union Telegraph Company) decided against the company upon both grounds. It held in the first place that the stipulation referred to did not bind the sender, but was void, as against public policy, declaring it to be essential for the public good that the duty of the company to use care and diligence should be strictly enforced. In the second place, the court held that the sender of the message was bound by it, even if erroneously delivered, but that he had his remedy over against the telegraph company. As between sender and receiver, however, it held that the party selecting the telegraph as the means of communication should bear the loss caused by the errors of the telegraph.

John B. Cornell.

The senior member of the great iron manufacturing firm of J. B. & J. M. Cornell, of New York City, died October 26, at Lakewood, N. J., in the 67th year of his age. He commenced work in this industry when fifteen years old, and in 1847, with a brother, opened a factory in New York City. The first year they employed only four or five hands, but their business grew steadily, and the firm now employs upward of 1,000 men, being among the largest manufacturers of iron for building purposes in the United States. They furnished a large part of the iron for the elevated railroad structures in New York, and are now furnishing the iron for the Brooklyn elevated railroads. Mr. Cornell was a trustee of the Broadway Savings Bank, a member of the Union League Club, and a prominent member of the Methodist Episcopal Church, being President of the Board of Trustees of Drew Theological Seminary. His gifts and charitable contributions to the church have been very large, and he always took a lively personal interest in its work. He leaves a widow and seven children.

Iron Brick Paving Stones.

Paving blocks called iron brick are now being introduced by Louis Jochum, of Ottweiler, near Saarbrucken, Germany. This brick is made by mixing equal parts of finely ground red argillaceous slate and finely ground clay, and adding 5 per cent of iron ore. This mixture is moistened with a solution of 25 per cent sulphate of iron, to which fine iron ore is added until it shows a consistency of 38° Baume. It is then formed in a press, dried, dipped once more in a nearly concentrated solution of sulphate of iron and finely ground iron ore, and is baked in an oven for 48 hours in an oxidizing flame and 24 hours in a reducing flame. The German government testing laboratory for building materials has reported favorably on this brick.

Simple Method for Reviving Persons Apparently Dead.

At a meeting of the last congress of German scientists this subject was discussed, and Dr. H. Frank mentioned that there are but two ways to stimulate the heart—electricity and mechanical concussion of the heart. The first is considered dangerous by him, as it may easily destroy the last power of contraction remaining in the organ. But what is termed "pectoral concussion" is decidedly preferable. Dr. F.'s method is as follows:

He flexes the hands on the wrist to an obtuse angle, places them both near each other in the ileo-cæcal region, and makes vigorous strokes in the direction of the heart and of the diaphragm. These strokes are repeated from fifteen to twenty times, and are succeeded by a pause, during which he strikes the chest over the heart repeatedly with the palm of his hand. In favorable cases this method is early successful, and sometimes a twitching of the lids or the angles of the mouth appears with surprising rapidity as the first sign of returning life. As soon as the symptoms are noted, the simple manipulations above described must be earnestly continued and persevered in from a half to one hour, for, with their cessation, the phenomena indicating beginning return of life also cease. Generally, the face assumes a slight reddish tint, and at the same time a faint pulsation may be felt in the carotids. By this method Dr. F. has seen life return in fourteen cases, among whom were such as had hung themselves, drowned, and asphyxiated by carbonic oxide, and in one case by croup. In three cases of asphyxia by coal gas and in one case of apparent death by chloroform the method described alone succeeded.—*Med. and Surg. Reporter.*

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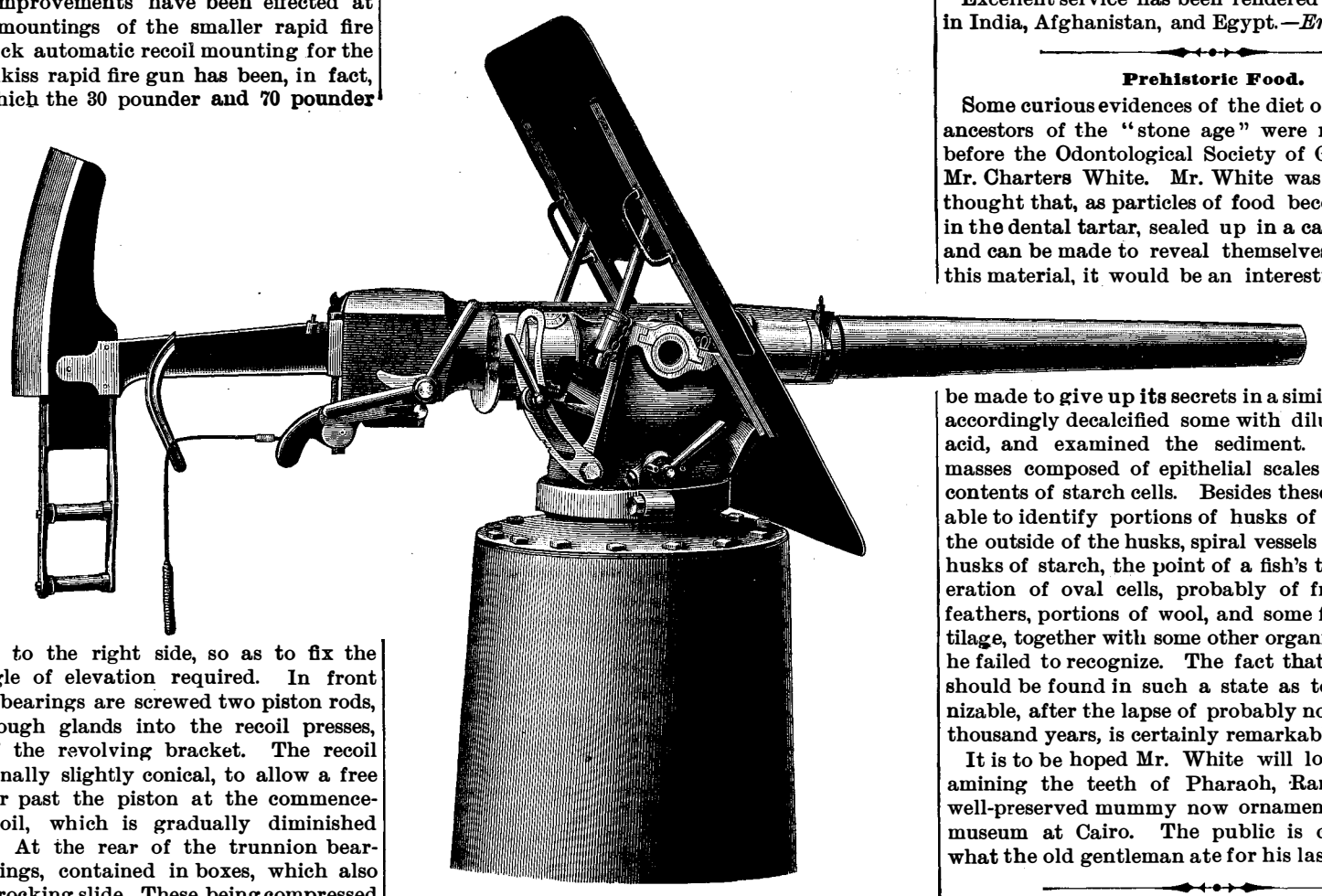
IMPROVED HOTCHKISS AND MOUNTAIN GUNS.

We publish some illustrations of the very fine collection of ordnance shown by Sir W. G. Armstrong, Mitchell & Co. at the Newcastle exhibition, these illustrations showing their present type of Hotchkiss gun and a 7 pounder mountain gun.

Considerable improvements have been effected at Elswick in the mountings of the smaller rapid fire guns. The Elswick automatic recoil mounting for the 3 pounder Hotchkiss rapid fire gun has been, in fact, the germ from which the 30 pounder and 70 pounder mountings have arisen.



IMPROVED HOTCHKISS GUN.

The gun itself is placed on a rocking slide, which pivots on trunnion bearings, the gun only moving backward and forward on the slide. The elevation and depression are given by rotating the slide round its trunnions by means of a shoulder piece attached to it. A clamping arc is fitted to the right side, so as to fix the gun at any angle of elevation required. In front of the trunnion bearings are screwed two piston rods, which pass through glands into the recoil presses, forming part of the revolving bracket. The recoil presses are internally slightly conical, to allow a free passage of water past the piston at the commencement of the recoil, which is gradually diminished toward its end. At the rear of the trunnion bearings are two springs, contained in boxes, which also form part of the rocking slide. These being compressed during recoil, serve to return the gun immediately to the firing position.

The rocking slide is provided with trunnions, which fit into a revolving bracket on which the gun is trained horizontally by means of the shoulder piece. This revolving bracket is carried on a pivot plate, to which it is attached by a clip ring in halves. A clamp fixes the bracket in any position. A gun metal pivot at the center of the mounting takes the weight off the mounting and reduces the friction when training. This bracket carries a thin steel shield for protection against rifle fire. Since the gun always recoils in the line of fire, the strains of recoil never vary. From the pressures indicated in the recoil presses during experiment, the maximum strain was found to be 6·7 tons and the mean strain 4·75 tons, the total amount of recoil being 4 inches. Assuming the powder pressure to be 15 tons per square inch, a strain of 40 tons per square inch would be given off on the stand at the center of the gun in the case of the non-recoil mounting, so that it is seen how much the mounting is relieved by the adoption of a certain though small recoil. A guard is fitted over the trigger in the pistol grip to prevent the use of the trigger for firing. A lanyard is attached to it, and led through the brass guard in rear, so that the man at the shoulder piece can fire by pulling the lanyard. A knot is made in the lanyard, so that the gun cannot be fired if it does not return into the firing position.

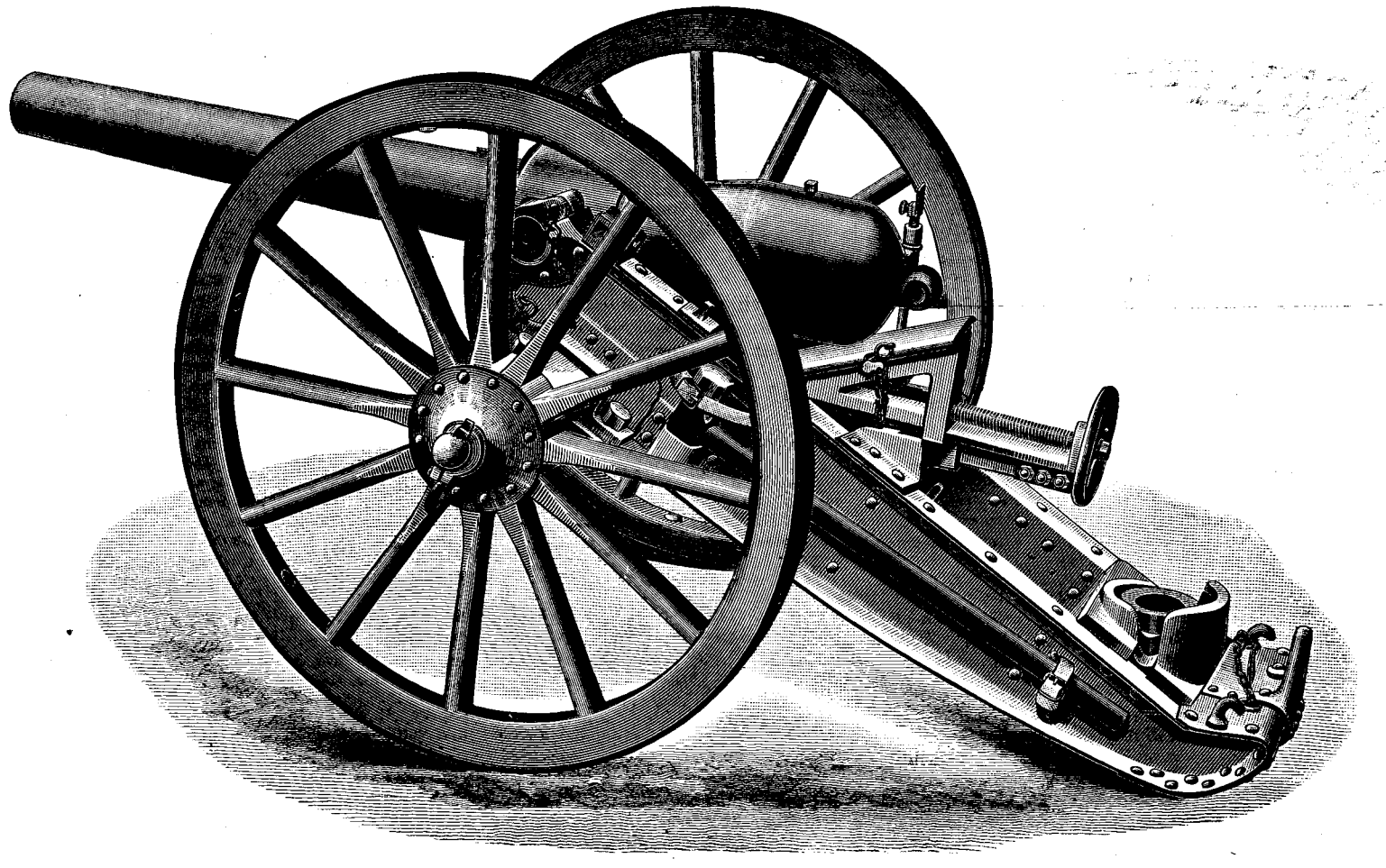
A rate of fire of about 20 rounds a minute has been obtained with the 3 pounder gun thus mounted.

Hotchkiss guns have been manufactured by Sir W. G. Armstrong, Mitchell & Co. in large numbers, especially for the British government. They are used extensively on board ship and in torpedo boats.

The 7 pounder mountain gun is intended for mountain service, for which purpose it is made in two parts, so that it can be easily transported on the back of mules. Its carriage and ammunition are carried in the same way. The total weight of the gun is 400 pounds; each part, therefore, weighs 200 pounds, and forms a load for one mule. Four other mules carry the carriages, ammunition, and gear.

Another 7 pounder shown at the exhibition is intended for a boat gun. The principal dimensions of the mountain gun are: Length (total), 70½ inches; length of bore, 66½ inches; length of rifling, 55½ inches; caliber, 2½ inches; weight, 400 pounds; weight of shell (filled), 7 pounds 6 ounces; weight of powder charge, 1½ pounds.

Excellent service has been rendered by this weapon in India, Afghanistan, and Egypt.—*Engineering.*



IMPROVED MOUNTAIN GUN.

Prehistoric Food.

Some curious evidences of the diet of our prehistoric ancestors of the "stone age" were recently brought before the Odontological Society of Great Britain by Mr. Charters White. Mr. White was struck with the thought that, as particles of food become imprisoned in the dental tartar, sealed up in a calcareous cement, and can be made to reveal themselves on solution of this material, it would be an interesting revelation if the tartar found on these teeth of the stone age could be made to give up its secrets in a similar manner. He accordingly decalcified some with dilute hydrochloric acid, and examined the sediment. It consisted of masses composed of epithelial scales mixed with the contents of starch cells. Besides these, Mr. White was able to identify portions of husks of corn, hairs from the outside of the husks, spiral vessels from vegetables, husks of starch, the point of a fish's tooth, a conglomeration of oval cells, probably of fruit, barblets of feathers, portions of wool, and some fragments of cartilage, together with some other organic remains which he failed to recognize. The fact that vegetable tissue should be found in such a state as to be easily recognizable, after the lapse of probably not less than three thousand years, is certainly remarkable.

It is to be hoped Mr. White will lose no time in examining the teeth of Pharaoh, Rameses II., whose well-preserved mummy now ornaments the Egyptian museum at Cairo. The public is curious to know what the old gentleman ate for his last breakfast.

Cotton Mills at the South.

In Georgia, at Columbus, the Swift Cotton Mills Company has added 8,000 spindles to its mill; the Muscogee, of the same place, a new mill of four hundred looms; the King Company, seven hundred looms and three thousand spindles; and at Augusta, Clarksville, Americus, West Point, Dalton, and Savannah, large improvements are making and new mills building. In South Carolina, the Pacelot Company, with 12,000 spindles, is building another mill of equal size, and the Pelzer Company, with 22,000 spindles, is building another large mill. At Marion, a $100,000 mill is in course of construction, one of $500,000 at Greenville, one at Clifton of $300,000, one at Bennettsville of $200,000, one at Columbia of $250,000, and one at Fort Mill of $160,000, while others are projected. A cotton oil mill, at Little Rock, Ark., which cost $200,000, is crushing two hundred tons of seed daily. A $1,000,000 cotton mill is going up at Galveston, and a $500,000 cotton mill at Dallas.—*L. A., in Wade's Fibre.*

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ENGINEERING INVENTIONS.

A throttle valve has been patented by Mr. Edwin W. Luce, of Bolivar, N. Y. This invention, construction, and arrangement of parts in a throttle valve is simple and durable in construction, and is designed to permit access to the working parts under any pressure of steam or water.

A globe or other valve has been patented by Mr. Edwin F. Briggs, of Brooklyn, N. Y. This invention covers a novel construction and combination of parts to dispense with a stuffing box in valvular structures, while providing against objectionable leakage, or so subduing the leakage that the escaping fluid or vapor will be relieved of force or pressure before it reaches an outlet.

A railroad switch has been patented by Mr. Walter R. Coppedge, of Floyd Court House, Va. Switching rails are combined with the main line rails, the switching rail at one side being made in sections that are hinged together, one of the sections being mounted on a pivot bolt and normally held so that its end adjacent to the main line rail shall be in a lower plane, with other novel features, whereby the main line will be always open.

A car coupling has been patented by Mr. Thomas B. Nutting, of Morristown, N. J. It has a slotted drawhead, a pivoted coupling hook having a pin and slot connection with the drawhead, the coupling link fulcrumed upon the coupling hook pivot, and carrying a rod engaging a shoulder on the coupling hook, the coupler being automatic and being also designed to couple with the ordinary form of link and pin coupling.

A rotary engine has been patented by Mr. Herman Knebel, of Birmingham, Ala. There is a rotary piston in a casing, with cams or inclines leading up to the head of the piston, an auxiliary cylinder being connected with and receiving steam from the interior of the casing, there being also a sliding blade, auxiliary piston, and various other novel features, in an engine designed to be easily controlled and reversed, and economical in the combustion of steam.

A cable grip for railways has been patented by Mr. Thomas O. Cooper, of Wilmington, Del. Combined with the car axles are bars having guide slots, a laterally adjustable frame with horizontal projecting arms fitting in the slots, vertical guides on the inner side and a vertically adjustable grip moving in the guides, with means for raising and lowering the grip, and other novel features, the invention being an improvement on a former patented invention of the same inventor.

AGRICULTURAL INVENTIONS.

A plow has been patented by Mr. Andrew J. Smith, of Wheatland, Oregon. This invention relates to turn plows, and provides a construction whereby the plow may be converted by a simple adjustment into either a single or double plow, having peculiar means for connecting and bracing the parts, by which it is made both light and strong.

A stacker has been patented by Mr. Marion A. Heinlen, of Lemoore, Cal. Combined with a pivoted and swiveled derrick post upon a truck is a sliding frame with a derrick arm pivoted thereto, with means for raising and lowering the frame and swinging the derrick arm, the apparatus being simple and durable and specially adapted for stacking hay or grain in the field.

MISCELLANEOUS INVENTIONS.

A lounge has been patented by Mr. James W. Reynolds, of Brooklyn, N. Y. This invention covers a novel construction and combination of parts composing the head and foot of the lounge, in connection with its body, whereby the lounge can be easily and conveniently changed into a bed.

An oil press cloth has been patented by Mr. Thomas Bennetts, of Brooklyn, N. Y. This invention provides for making the press cloth of two layers of substantially equal size folded upon each other and united to form a partially open folded edge, or a folded slit having its edges loosely united by a suitable stitch.

A nut lock has been patented by Mr. Samuel H. Ray, of St. 'Louis, Mo. The nut is formed with an eccentric groove, a washer having a flange projecting over the nut, and a key fitting in the groove of the nut and engaging the flange of the washer, the lock being readily applied, and preventing any backward movement or loosening of the nut.

A desk has been patented by Mr. Charles Emmel, of Cambridge, Mass. It has on its body a hinged top or lid, with plates hinged to the lid to swing at an angle to the hinge, and stop lugs on the hinged plates adapted to engage the body, with other novel features, making an article of furniture adapted for use either as a table or a desk.

An axle nut has been patented by Mr. George B. Lumpkin, of Lexington, Ga. This invention provides a simple and easily operated device by which to take up the wear of the hub box of a vehicle, and cause the box to fit properly at all times between the inner flange of the axle arm and the nut screwed on the outer end of the arm.

A weather strip for doors has been patented by Mr. James K. Patterson, of Crete, Neb. It is of sheet metal, and hinged by a peculiar spring hinge and an ordinary butt hinge to a cleat fixed by screws to the outer face of the door near its lower edge, and is designed to automatically close to the door sill as the door closes, for excluding rain, snow, wind, etc.

A draught equalizer has been patented by Mr. Eli R. Parker, of Wyoming, Ontario, Canada. This invention covers a novel combination and arrangement of parts designed to afford a draught equalizer of great strength and simplicity, adapted to plowing in orchards, working a horse power, and in other situations requiring a short doubletree, and for other purposes.

A padlock has been patented by Messrs. Charles D. Smith and Robert H. Thompson, of Hartsell's, Ala. It is a comparatively inexpensive combination lock, which cannot be opened by one not knowing its interior construction, and how to operate its bolts or pins, and a button at the outside of the lock, certain features of the invention being also applicable to flat plate locks.

An aerial vessel has been patented by Mr. William N. Hutchinson, of Wellesbourne, Bideford, Devon County, England. Combined with the skin or envelope of a balloon is a compressor, acted on by weight or spring power, to press against the inflated balloon with an approximately constant pressure, whereby the skin or envelope is kept distended and free from plaits.

A washing machine has been patented by Messrs. David C. Barnard and Edward L. Wallace, of Lockport, N. Y. Its construction is such that the clothing may be manipulated as desired without being touched by the hand, and the clothing being washed can be kept from contamination by the dirt previously washed out, the invention covering various novel details and combinations of parts.

A fodder press has been patented by Mr. George H. Clemmer, of Arcanum, Ohio. Combined with a base are two presser heads, one mounted to slide on the base toward the other, there being an operating lever pivoted to the base and a connecting rod pivotally connected at one end to the operating lever and at the other end to the sliding presser head, the press being very powerful, efficient, and convenient.

A fruit evaporator has been patented by Mr. William S. Plummer, of Rochester, N. Y. Its construction is such that different rows of trays containing the fruit may be forced along in such order as to obviate the placing of green fruit under partially evaporated fruit, and the fruit which evaporates the fastest may be forced forward out of the evaporating chamber without disturbing the other rows.

A dish washing machine has been patented by Phebe Ella Cox, of Readington, N. J. It consists of a water tank with a dish car mounted on casters, to be wheeled to and fro a short distance in the tank, the car having partitions, and there being various novel features, whereby water may be made to rush through upon all the dishes it contains, carrying off deposited matter through the perforated partition walls and end openings.

SCIENTIFIC AMERICAN
BUILDING EDITION.

NOVEMBER NUMBER.

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2. Plate in Colors of a Frame Dwelling, situated at Belleville, N. J., costing Two Thousand Five Hundred Dollars, with full specifications, floor plans, sheet of details, etc.
3. Page Engraving of Holbrook Hall, New York City, an Eight Story Apartment House, lately condemned for dry rot.
4. Plans for a School House costing between Eight and Nine Thousand Dollars.
5. Half page Engraving of a Residence at Battenhall Park, Worcester, England.
6. Perspective view, with floor plans, of a Dwelling costing Four Thousand Five Hundred Dollars.
7. Drawing of a Reception Pavilion, Geneva.
8. Illustration of the New Railroad Men's House, New York. A Club House costing One Hundred Thousand Dollars.
9. Design of an Attractive Residence at Minneapolis, Minn.
10. A Church of moderate cost, with first story plan. Intended for 450 seats.
11. Engraving of a Two Story and Attic House erected at Montclair, N. J., with floor plans. Cost, Thirty-seven Hundred Dollars.
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13. Page Engraving of the New Monument and Tomb of M. Thiers, Cemetery of Pere la Chaise, Paris.
14. Design for an Entrance. Half page engraving.
15. Perspective and floor plans of a House costing Three Thousand Eight Hundred Dollars.
16. Design for a City Front. W. H. Powell, Architect, London.
17. Floor plans and perspective of a House for a narrow lot. Cost, Four Thousand Dollars.
18. Perspective and floor plans of a Four Thousand Five Hundred Dollar Residence.
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The *Railroad Gazette*, handsomely illustrated, published weekly, at 73 Broadway, New York. Specimen copies free. Send for catalogue of railroad books.

The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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NEW BOOKS AND PUBLICATIONS.

ELECTRICITY FOR PUBLIC SCHOOLS AND COLLEGES. By W. Larden, M.A. London: Longmans, Green & Co. 1887. Pp. xx, 475.

This work is a convenient treatise on magnetism and electricity. The subject is very fully treated, and presented in very attractive shape. It is illustrated with the familiar cuts, some of which show some signs of use. The subject of practical tests and experiments is extremely well presented. It may be safely and confidently recommended to those wishing a manual for study and reference. It is very fully indexed.

ASTRONOMY BY OBSERVATION. By Eliza A. Bowen. New York: D. Appleton & Co. 1886. Pp. 90.

This work is an attractive one in its style of production. It includes numerous star maps, colored plate of spectra and other diagrams, all beautifully presented. The principal star charts are in a blue sky, the stars being white. Their completeness and appearance leave nothing to be desired. Several beautiful views of "moon scenery" give a vivid idea of the landscapes of the satellite. Saturn and the other planets are duly figured. Sun spots, granules, and pores of the sun's surface are treated of at considerable length. The text gives a very lucid account of astronomy, and the whole work is highly to be commended, as converting what is ordinarily considered a dry subject into a very vivid and interesting one.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION, TO JULY, 1885. Washington: Government Printing Office. 1886. Pp. xviii, 996.

This report contains the financial statement, list of correspondents and of institutions to which the Smithsonian Institution publications are sent. After this class of information, reports on the year's work in astronomy, physics, and cognate branches of natural science by different authors are given. This forms an admirable review of the progress of science, and the work can be warmly commended to our readers.

QUANTITATIVE CHEMICAL ANALYSIS BY ELECTROLYSIS. By Dr. Alexander Classen. Translated by William Hale Herrick, A.M. New York: John Wiley & Sons. 1887.

To the chemist who has kept abreast of the analytical methods of the day, it is only necessary to say that this is a *resume* and collected description of "Classen's Methods" to recommend the book. The electrolytic separations devised by this chemist have met with such success, and have filled so real a void in analytical work, that they have everywhere met with the highest praise. His beautiful precipitation of metallic iron from the solution of ite oxalate is especially a noteworthy step in modern analysis. The work is illustrated with cuts of batteries, apparatus, etc., while many tables or results testify to the admirable correctness of his methods.

BULLETIN OF THE UNITED STATES FISH COMMISSION. VOL. VI., FOR 1886. Washington: Government Printing Office. 1887. Pp. 495.

This volume is a collection of over 136 monographs on ichthyological subjects. The catalogue of its contents is far too extensive for us to notice in a review of this length. The introductory notice bears a melancholy interest in its signature, the name of the lately deceased Spencer F. Baird. The subjects treated range all the way from "A Man Killed by a Sword Fish" and "A Curious Knife Found in the Flesh of a Cod Fish" to "Report on Examination of Clupeoids," etc. Hence it seems obvious that there is something in the book to please all tastes.

THE MANUAL OF PHONOGRAPHY. By Benn Pitman and Jerome B. Howard. 200,000th. Cincinnati: Phonographic Institution. 1887. Pp. 144.

This is a short manual on the well known Pitman system of phonography, giving many practical exercises and plates for dictation or practice.

SIXTH ANNUAL REPORT OF THE UNITED STATES GEOLOGICAL SURVEY TO THE SECRETARY OF THE INTERIOR. 1884–85. By J. W. Powell. Washington: Government Printing Office. 1887. Pp. xxix, 570.

This elegant publication, forming a massive quarto volume, cannot be adequately treated of here. In typography and plates of fossils, it leaves nothing to be desired as regards perfection of production. It gives one's patriotism an impulse to find the scientific work of the United States so creditably presented to the world. It includes, besides the director's report, administrative reports by leading authorities engaged in the work of the survey. Among these may be noted Mr. Henry Gannett, Professor Rafael Pumpelly, Professor N. S. Shaler, Dr. F. V. Hayden, Professor O. C. Marsh, and many other well known names will be found as authors of papers on various subjects. The illustrations comprise 65 plates and 57 figures in the text.

A TREATISE UPON CABLE OR ROPE TRACTION. By J. Bucknall Smith, C.E. London: *Engineering;* and New York: John Wiley & Sons. 1887. Pp. xii, 195.

This work gives a reasonably full compilation of the generalities of cable traction. Starting out as an English writer, he feels obliged to use the word "tramways," but very sensibly attacks it as wholly indefensible. Mining and railway rope haulage are considered first; then specific examples are described, such as the California roads, those of other parts of the United States, and New Zealand, and European roads; then the cost of constructing and working the system, general considerations, and the manufacture of wire ropes are given. In an appendix the City of London and Southwark Cable Traction Subway and the Glasgow Underground Rope Railway are described. The work is well printed and includes 76 illustrations.

A POCKET ATLAS OF THE WORLD. 1887. Ivison, Blakeman & Co., New York and Chicago. Pp. 224.

In this little work, which is sold for the modest price of twenty-five cents, is contained a complete atlas of the world.

THE STORY OF METLAKAHTLA. By Henry S. Welcome. Illustrated. Saxon & Co., London and New York. 1887. Pp. xiv, 483.

In this book are detailed the achievements of Mr. William Duncan, who established a settlement among the Indians near Alaska, civilizing them and bringing about most excellent results as a missionary. This story is a most remarkable one, and is of uniform tenor of success and prosperity until the Anglican Bishop of the region interfered. Then trouble arose, and the conduct of the Bishop is bitterly complained of in the book. The last proposal of the missionary seems to have been to move his people to the United States, as it appeared that dissension and consequent failure was to be the outcome of the conflict between him and the church authorities. The story is a curious and interesting one.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) C. V. A. asks: 1. What cement should be used to fasten to the revolving plate of a Toepler-Holtz electrical machine the brass buttons against which the wire brushes rub? Will shellac answer the purpose? A. Shellac or sealing wax will answer. Equal parts of pitch and gutta-percha melted together forms a good cement for this purpose. 2. What cement should be used for attaching the paper and tin foil inductors to the stationary plate? A. Shellac varnish answers very well. 3. Can common window glass be used for making the plates? A. Yes. 4. How can I cut a 3 inch hole in a plate of glass? A. Make a number of concentric cuts with a diamond. Back up the glass around the outer circle with plaster of Paris. After the plaster sets, drop a bullet on the center of the circle from a distance of two feet or more.

(2) J. A. A. asks (1) which way a valve should be set in piping any steam apparatus; that is, should the steam when the valve is shut strike the top or bottom of valve? A. Always connect valves so as to shut against the constant steam pressure. This will allow of repacking the spindle stuffing box at all times. 2. Which is the most economical, to run with full boiler, that is, water up to top gauge cock, or down to one and one-half or two gauges, as the case may be? A. The water line in boilers for economy, which means dry steam, should not be at the high water mark, but at a safe medium between the high water mark, and the top of the tubes. As a general rule for horizontal tubular boilers of medium diameters, one and a half inches above the top of the upper tubes, to each foot of diameter, is a safe and economical height for the water line. This should correspond with the middle gauge cock when three are used or to the second (from bottom) when four are used. There is much difference of opinion among constructing engineers as to the exact positions of gauge cocks and water gauge, so that it becomes a necessity for those in charge of boilers to know the relative position of water gauge and gauge cocks above the tubes.

(3) M. asks: What will clean old printer's ink barrels? A. Kerosene.

(4) L. M.—By the census of 1880, there were 31,668 persons engaged in mining iron ore and 140,978 persons were employed in the manufacture of iron and steel. The whole number of mechanics engaged in manufactures was 2,738,950.

(5) N. F. H. asks: 1. I wish a receipt for making a paste polish for stoves. A. Black lead 1 pound, water 4 ounces, turpentine 4 ounces, sugar 1 ounce. Mix thoroughly. 2. Give me the process of making condensed milk. A. See the article "How Condensed Milk is Made," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 156.

(6) W. F. L. asks the best receipt for japanning light castings without baking. A. You may purchase air-drying black varnishes through the varnish trade. A very cheap black varnish, quick drying, may be made by mixing lamp black with shellac varnish, adding a little 95 per cent alcohol for the required thinness.

(7) F. D. asks: If the size of a dynamo is doubled, does the lighting power also increase in the same proportion? A. The increase in power will be about quadrupled if the linear dimensions are doubled. When the sectional areas are doubled, the machine will have little more than double the power. If you intend making a machine larger than that described in SUPPLEMENT No. 161, we would advise you to follow instructions given in SUPPLEMENT No. 600.

(8) E. M. S. desires a receipt or method better than soap, water, and scrubbing brush for cleaning one's hands. A. Put ¼ pound Glauber's salt, ¼ pound chloride of lime, and 8 ounces of water into a little wide-mouthed bottle, and when required for use pour some of the thick sediment into a saucer and rub it well over the hands with a nail brush.

(9) H. S. B. asks: 1. If a ball is fired straight upward, with an initial velocity of 530 meters per second, how high will it go? A. 41,000 feet. 2. How long will it take to go and how long to return? A. 49 seconds going up, 52 seconds coming down. 3. Give the velocities at the beginning and end of each second going and returning. A. You can learn how to figure the several answers from Haswell's Engineer's Manual, which we mail for $4, and from other works. 4. Will its penetrating power be the same practically at the end of the last second of its fall as when it left the muzzle of the gun? A. No; you must deduct for the friction of the air. 5. Does the air offer more resistance in the ascent than in the descent? A. Yes; by the value of the greater velocity. The propelling force overcomes both gravity and air friction to send the ball up. Only one of these factors, gravity, pulls the ball down.

(10) J. S. writes: 1. I make a beverage with essence of pineapple and pear acid, tart and burnt sugar. It is made in a tub and drawn through a beer machine, it is clear and palatable, but I cannot get it to effervesce as bottled ginger beers do. A. This result can probably be brought about by the addition of sugar. See the articles on "Effervescing Beverages," contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 270, and also in the article on "Champagne Cider," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 313, which we send for ten cents each. 2. In your journal, December 25, 1886, you give a formula for foam sirup made from quillaya bark. It is good and answers well, but a bit too expensive. Can you tell me how the liquid foamine is made? A. The foam may be produced by adding a suitable quantity of gum arabic, 2 to 4 ounces, dissolved in an equal amount of water. The usual mixture however, is quillaya bark 4 ounces, alcohol 4 ounces, glycerine 4 ounces, and water 8 ounces. Exhaust by percolation to make 1 pint of tincture 3. How is the rose colored stain made that ladies use for their faces? It is only removed with lemon juice. A. Use finely bolted talc 4 ounces and carmine 2 drachms, with a little warm and dilute solution of gum tragacanth. 4. I use burnt sugar to color my beverage with. It is objected to by total abstainers as looking too much like ales. Can you tell me of a nice wine coloring that will not be affected by the acid? A. You can diminish or increase the amount of burnt sugar used when a suitable shade is obtained. This is more satisfactory than purchasing coloring materials, which you may buy at a chemist's shop. 5. Will peroxide of hydrogen mixed with spirits of ammonia turn white hairs black? A. You cannot. See the article on "Hydrogen Peroxide," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 339.

(11) W. J. M. writes: 1. Where an engine is running machinery of very irregular load or motion, should not the slide valve be adjusted on steam ports so as to give equal lead on each port in order to secure as regular motion as possible? A. Yes. 2. Is it customary to give one-sixteenth to one-eighth inch more lead on front steam port than on rear port? A. This is sometimes done by engineers seeking the finest adjustment and allowing for piston rod area. 3. When admitting water and steam through the angle valves in to glass water gauge (new gauges), how do you proceed to avoid breakage of glass tube or gauge? A. Open the drip, then open the upper valve slightly and allow steam to blow through. Then open the lower valve slowly allowing the cold water in the lower pipe to run out. When running hot, close the drip and the hot water will rise in the gauge. Then open both valves wide. The cyclopedia you ask about describes many governors.

(12) R. B.—Transparent cosmetique is nothing more than a transparent soap, made with alcohol. Take a good suet or tallow soap, which is cut into very thin ribbons and exposed to the air and sun until it is thoroughly dried. It is then pulverized in a marble mortar and passed through a fine sieve. The powder thus obtained is directly dissolved in strong boiling alcohol. While the soap is liquid, the colors and perfumes are incorporated with it, 3½ gallons of alcohol of 0·849 sp. gr. are generally used with 50 pounds of soap. A still heated by steam or hot water is used for this operation, as a considerable quantity of alcohol would be lost in a common heating pan, and the direct application of fire would destroy the transparency of the soap.

(13) W. N. R. asks the form and use of a railroad Y. A. It is a turn out from and return to the main track in the form of a letter Y, sometimes used instead of a turntable. The term is also applied to a sort of frog used on horse car roads instead of a switch.

(14) W. S. asks the difference in the terms soluble, insoluble and reverted phosphates, or is soluble and reverted the same thing? A. In the manufacture of fertilizers the tri calcium phosphate is treated with sulphuric acid in order to convert it into the soluble monocalcium phosphate; but as it very rarely happens that sufficient acid is used for this purpose, we have three determinations that are usually made in the analysis of a fertilizer. 1. The total phosphoric acid. 2. The soluble phosphoric acid, and 3. The insoluble phosphoric acid.

(15) T. D. McC. asks: 1. How can I make a gelatine pad for copying writing? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 438, for this information. 2. In oiling the blades of my knife the white bone handle became discolored with the kerosene. What will restore its white color? A. Immerse in a dilute solution of binoxide of hydrogen. 3. How much No. 24 insulated wire should I use on each core of an electric door bell, and what will be the resistance? A. Use two ounces on each leg of the magnet, giving a total of about 5 ohms resistance.

(16) A. L. L.—The plant sent to be named is *Solanum mammosum*.

(17) C. D. asks: How many cells of the simple plunge battery described in SCIENTIFIC AMERICAN of August 20 will be required to produce the voltaic arc? A. About sixty.

(18) A. E. asks: Can the wire of an induction coil of the secondary current be used after it is broken in several places, by twisting the ends together? It is No. 26, silk covered. A. Twist the ends together and solder them, washing off carefully and drying before rewinding.

(19) E. D. asks what proportions to use of white lead and gum arabic powder, for a preparation for stamping with the perforated patterns. A. The white powder used consists of white lead with just sufficient gum arabic to make it adhere when pressed over with a heated iron. 2. How to clean the lead out of a rifle without injuring the barrel. A. Special brushes are made for this purpose, but when the lead is bright, as it is likely to be from recent firing, a good plan is to shake a small quantity of mercury well in the barrel, and it will loosen the lead so it will come out readily with a good swabbing.

(20) C. J. L. asks the ingredients used in the manufacture of the dye on a piece of wool he sends, saying it is a fast color and the skins are used in the trimming of saddles in Texas. A. The coloring matter is one of the fast aniline yellow dyes, known under the name of naphthol. They are used in the proportion of about 1 pound of dye to 100 of the material.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

October 25, 1887,

AND EACH BEARING THAT DATE.

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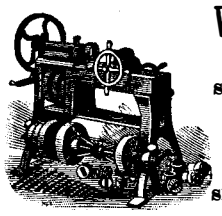
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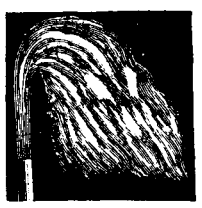
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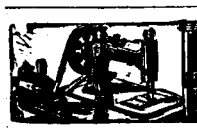

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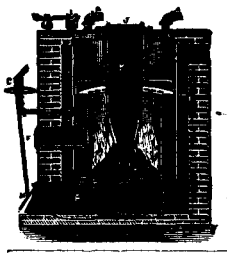

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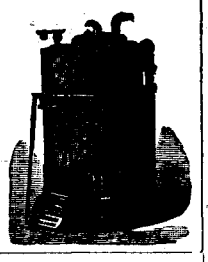

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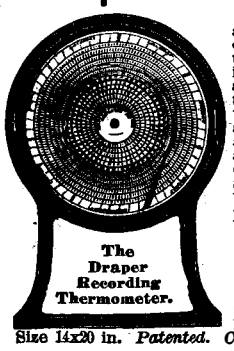

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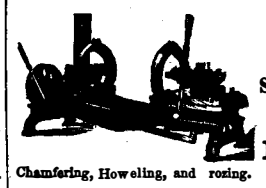

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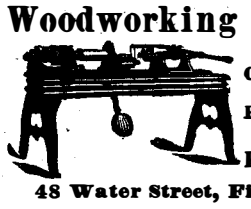

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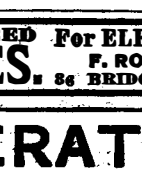

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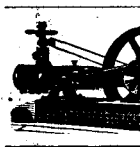

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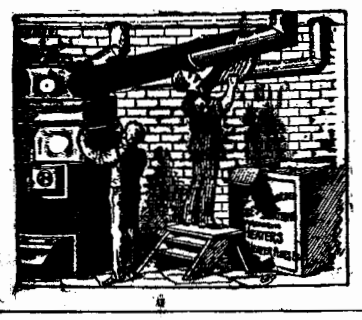

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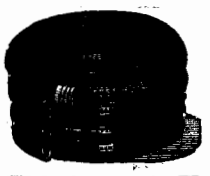

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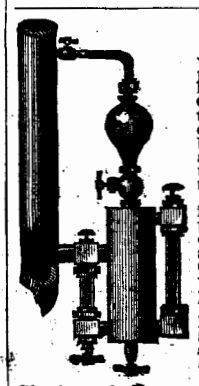

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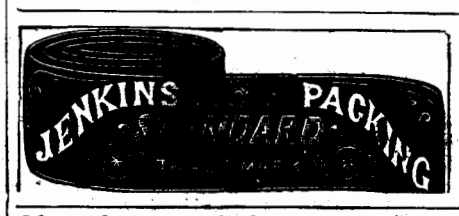

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